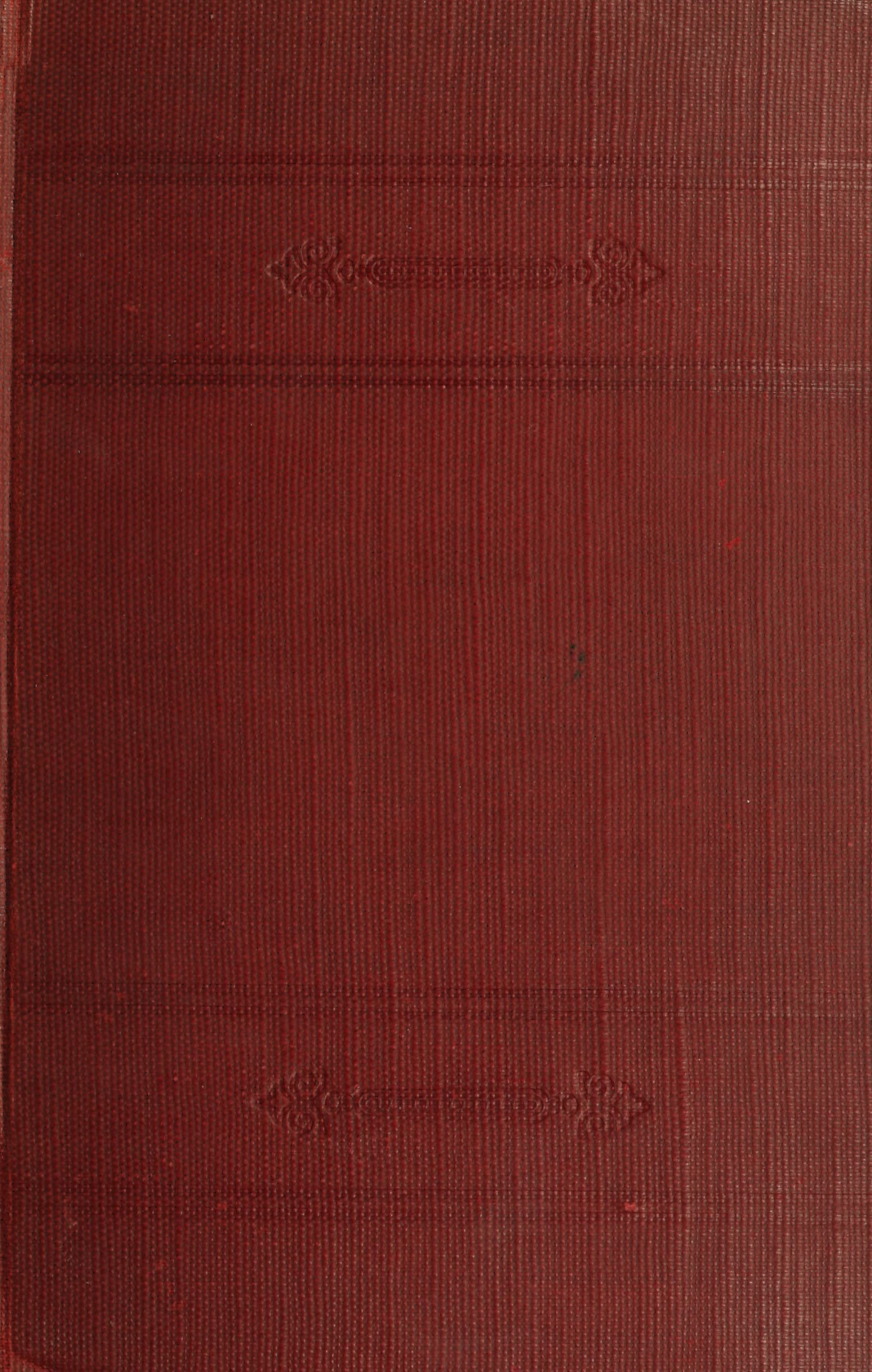

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Fishes

Division of Fishes,
U. S. National Museum

BUREAU OF FISHERIES

REPORT

OF THE

UNITED STATES COMMISSIONER OF FISHERIES

FOR THE FISCAL YEAR 1914

WITH

APPENDIXES

HUGH M. SMITH
Commissioner

DEPARTMENT OF COMMERCE
UNITED STATES OF AMERICA

Smithsonian Institution,
FEB 4 1916
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WASHINGTON
GOVERNMENT PRINTING OFFICE
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REPORT OF THE
UNITED STATES COMMISSIONER OF FISHERIES
FOR THE FISCAL YEAR ENDING
JUNE 30, 1914

Bureau of Fisheries Document 807

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REPORT

OF THE

COMMISSIONER OF FISHERIES.

Department of Commerce,
Bureau of Fisheries,
Washington, October 12, 1914.

Sir: There is submitted herewith a report giving an outline review of the operations of the Bureau of Fisheries during the fiscal year ended June 30, 1914.

THE FISHING INDUSTRY.

GENERAL CONDITION OF THE FISHERIES.

The general condition of the fishing industry of the United States at the present time is satisfactory. Each year shows an increased aggregate output with increased income to the fishermen, dependent on various factors. Among the influences tending to produce an augmented catch are (1) natural expansion of fishing operations in fields where the limit of productivity has not been reached, (2) exploitation of new or little-resorted-to grounds, (3) utilization of aquatic resources formerly neglected or little used, and (4) actual increase in abundance of products owing to artificial propagation, protective measures, or natural causes.

Certain branches, however, which have long exhibited a downward trend continue in the same condition; others are showing a sharp decline of comparatively recent origin; and still others are affected by a purely temporary or seasonal scarcity of supply. In the case of some species, a markedly diminished catch is attended by an actual increase in the income of the fishermen therefrom because of an artificial rise in price. Under such circumstances, fishermen are likely to report a particular fishery as in excellent condition and thus to create an entirely erroneous impression which the fish-eating public finds difficulty in reconciling with personal experience.

Among the more valuable food fishes about which there is reason for the most solicitude are the anadromous species of the Atlantic seaboard, particularly the shad and the alewives or river herrings. Notwithstanding the most unmistakable demand for immediate and radical action on the part of States to preserve these fisheries, nothing noteworthy has been accomplished, and vast food supplies and sources of income to the fishermen are being sacrificed.

The distressing conditions which have been permitted to arise and continue in Chesapeake Bay and tributaries were referred to at some length in the last annual report. The season of 1913 was stated to be the worst in some respects for shad and alewives in 40 years. The season of 1914 was even worse, and a general failure of the fisheries in both salt and fresh water was recorded. This failure depended solely on the scarcity of fish. The only measure of relief that has been afforded to the sadly harassed schools of spawning fish has come from the exercise by the Federal Government of arbitrary authority over the waters for purposes of navigation, which has insured the opening of narrow lanes through the mazes of fixed nets that fringe the shores and block the streams.

NEW ENGLAND VESSEL FISHERIES.

The most extensive and valuable sea fisheries of the country are those centering at Boston and Gloucester, Mass., where, for a long term of years, detailed statistical and other data have been collected by the Bureau through local agents. The statistics are published monthly and annually in one-sheet bulletins which are issued to the trade. The extent of these fisheries in the calendar year 1913 is shown by months and by fishing grounds in the tables which follow.

Taken as a whole, the New England vessel fisheries were less successful in 1913 than in 1912. The catch of cod, cusk, haddock, and hake decreased, while pollock, halibut, mackerel, and swordfish were caught in larger quantities. More fares of fish were landed and the value of the product was greater than in 1912.

The fleet numbered approximately 250 sailing vessels and 175 steam and gasoline screw vessels. Vessels landing their catches at Boston made 3,582 trips, aggregating 92,351,594 pounds, valued at $2,988,552; vessels making Gloucester their headquarters brought in 5,247 trips, aggregating 69,865,192 pounds, valued at $1,994,465. The combined fleets landed 8,829 fares, comprising 162,216,786 pounds and having a first value of $4,983,017. Compared with 1912, there were an increase of 1,180 trips, a decrease of 20,487,273 pounds, and an increase of $203,758. Practically all receipts at Boston are fresh, while at Gloucester about three-sevenths of the catch are salted. The herring fishery on the treaty shores of Newfoundland showed a marked decline in both frozen and salt fish.

Quantity and Value of Certain Fishery Products Landed at Boston and Gloucester, Mass., by American Fishing Vessels During the Calendar Year 1913, Shown by Months.

Month.	Number of trips.	Cod.				Cusk.				Haddock.			
		Fresh.		Salted.		Fresh.		Salted.		Fresh.		Salted.	
		Pounds.	*Value.*	*Pounds.*	*Value.*	*Pounds.*	*Value.*	*Pounds.*	*Value.*	*Pounds.*	*Value.*	*Pounds.*	*Value.*
LANDED IN BOSTON.													
January	266	1,121,500	$44,345	....	....	307,600	$8,025	....	....	4,367,200	$150,709	....	....
February	212	764,250	34,125	....	....	201,000	5,079	....	....	4,473,500	171,642	....	....
March	276	1,253,600	49,275	....	....	306,500	6,797	....	....	4,735,000	119,444	....	....
April	333	2,193,400	66,029	....	....	525,800	7,287	....	....	4,256,250	88,185	....	....
May	205	1,899,675	50,402	....	....	274,400	4,481	....	....	2,513,300	67,752	....	....
June	271	2,133,030	72,980	....	....	195,900	3,212	....	....	2,980,550	81,635	....	....
July	352	1,835,750	65,682	....	....	170,000	3,189	....	....	4,217,350	78,134	....	....
August	417	2,350,900	74,553	....	....	218,300	4,323	....	....	4,054,000	89,635	....	....
September	331	2,567,607	91,357	....	....	99,320	2,188	....	....	4,311,605	126,995	....	....
October	335	1,454,550	57,819	4,000	$180	214,700	4,771	3,000	$60	4,446,450	139,202	2,500	$75
November	336	1,248,809	41,608	....	....	492,194	7,755	....	....	3,219,085	113,723	....	....
December	248	993,647	34,943	....	....	276,834	5,164	....	....	2,434,249	108,637	....	....
Total	3,582	19,815,718	683,118	4,000	180	3,282,548	62,271	3,000	60	46,008,539	1,335,693	2,500	75
LANDED AT GLOUCESTER.													
January	614	299,550	13,280	652,207	29,861	6,640	98	2,966	74	615,400	22,606	4,090	61
February	513	316,735	17,729	107,145	5,305	18,345	238	1,470	37	303,985	14,089	6,035	90
March	699	451,430	18,063	185,325	8,916	23,665	312	2,170	49	1,038,680	32,830	3,255	49
April	671	1,532,639	39,489	222,070	10,649	199,107	2,830	2,370	55	2,111,820	41,928	5,820	88
May	517	2,400,290	53,197	1,700,185	67,901	281,615	3,916	11,043	249	535,390	9,164	19,715	297
June	211	1,315,241	24,983	2,372,167	90,604	140,598	1,939	9,125	205	248,275	2,234	38,900	584
July	178	703,595	14,166	3,405,039	135,942	576,380	7,796	27,125	606	1,086,230	9,777	36,955	555
August	106	592,114	12,313	1,336,682	53,798	616,207	8,314	40,882	843	777,468	7,655	31,539	473
September	118	840,236	17,639	1,692,605	68,353	309,794	4,711	14,921	330	497,204	5,001	45,730	686
October	181	419,937	8,784	1,607,310	75,816	216,481	4,014	12,590	283	132,645	1,333	30,862	463
November	726	337,165	12,650	2,202,295	96,202	110,907	2,231	14,170	350	75,375	2,149	8,118	143
December	713	152,581	6,654	200,552	9,283	33,402	616	1,715	41	4,785	265	3,350	68
Total	5,247	9,361,513	238,947	15,683,582	652,630	2,533,141	37,015	140,547	3,122	7,427,257	149,031	234,369	3,557
Grand total	8,829	29,177,231	922,065	15,687,582	652,810	5,815,689	99,286	143,547	3,182	53,435,796	1,484,724	236,869	3,632
Grounds E. of 66° west longitude	714	8,312,784	203,506	12,891,996	530,044	2,513,819	40,907	77,276	1,750	6,614,232	160,755	88,662	1,349
Grounds W. of 66° west longitude	8,115	20,864,447	718,559	2,795,586	122,766	3,301,870	58,379	66,271	1,432	46,821,564	1,323,969	148,207	2,283
Landed at Boston in 1912	3,676	23,413,300	784,382	....	....	3,066,100	61,176	....	....	52,777,200	1,162,994	....	....
Landed at Gloucester in 1912	3,973	12,105,520	243,069	18,186,308	646,582	3,251,068	43,301	163,369	3,765	10,447,589	169,874	322,441	4,458

QUANTITY AND VALUE OF CERTAIN FISHERY PRODUCTS LANDED AT BOSTON AND GLOUCESTER, MASS., BY AMERICAN FISHING VESSELS DURING THE CALENDAR YEAR 1913, SHOWN BY MONTHS—Continued.

Month.	Hake.				Pollock.				Halibut.			
	Fresh.		Salted.		Fresh.		Salted.		Fresh.		Salted.	
	Pounds.	*Value.*	*Pounds.*	*Value.*	*Pounds.*	*Value.*	*Pounds.*	*Value.*	*Pounds.*	*Value.*	*Pounds.*	*Value.*
LANDED AT BOSTON.												
January	435,350	$18,766	......	......	177,125	$5,260	......	......	62,630	$9,832	......	......
February	270,750	13,625	......	......	114,890	4,511	......	......	33,361	7,716	......	......
March	309,700	13,012	......	......	114,600	5,501	......	......	91,225	12,498	......	......
April	834,100	20,089	......	......	269,150	5,577	......	......	134,480	13,415	......	......
May	798,900	12,280	......	......	173,500	3,034	......	......	77,680	6,759	......	......
June	1,455,900	22,029	......	......	236,600	5,457	......	......	220,815	15,625	......	......
July	695,550	14,837	......	......	392,400	8,528	......	......	165,735	13,891	......	......
August	867,500	15,749	......	......	671,500	11,384	......	......	163,600	11,910	......	......
September	859,860	23,725	500	$10	974,610	22,066	......	......	62,544	6,937	......	......
October	1,608,500	42,098	8,000	228	400,810	13,682	250	$3	39,220	4,712	......	......
November	1,473,912	25,830	......	......	319,616	5,628	......	......	27,175	4,579	......	......
December	509,638	14,392	......	......	471,634	7,408	......	......	25,455	6,388	......	......
Total	10,119,660	236,432	8,500	238	4,316,465	98,036	250	3	1,103,920	114,262	......	......
LANDED AT GLOUCESTER.												
January	86,600	4,078	8,050	121	490,315	16,666	11,110	167	64,009	11,098	2,275	$228
February	35,510	2,188	3,910	59	385,070	18,545	14,935	224	154,000	19,032	70	7
March	23,115	1,305	2,160	32	123,927	6,286	7,740	116	208,020	22,955	3,051	305
April	109,490	1,754	1,915	28	305,300	5,416	4,150	62	415,918	39,811	111	10
May	374,260	3,618	17,555	263	991,995	10,514	17,570	263	816,546	48,100	17,815	1,582
June	387,630	3,489	41,683	626	420,384	2,942	41,942	628	480,723	33,887	28,914	2,531
July	519,425	4,675	67,977	1,021	95,185	1,223	49,505	743	548,369	37,203	25,609	2,241
August	572,155	5,862	47,970	721	53,537	443	29,450	442	486,672	34,458	1,739	152
September	437,700	4,934	44,412	764	95,529	924	35,595	541	207,645	22,465	443,203	42,997
October	515,879	6,472	52,565	913	57,300	1,335	11,541	166	87,795	8,361	6,441	645
November	411,818	7,269	29,005	572	4,250,777	47,195	7,020	100	133,255	11,960	2,365	237
December	146,746	4,116	19,800	354	3,445,384	48,468	5,425	109	49,689	5,277	......	......
Total	3,620,328	49,760	337,002	5,474	10,714,703	159,957	235,983	3,561	3,652,641	294,607	531,593	50,935
Grand total	13,739,988	286,192	345,502	5,712	15,031,168	257,993	236,233	3,564	4,756,561	408,869	531,593	50,935
Grounds E. of 66° west longitude	3,483,499	54,206	319,149	5,221	346,773	5,126	76,016	1,145	3,952,238	323,196	529,254	50,708
Grounds W. of 66° west longitude	10,256,489	231,986	26,353	491	14,684,395	252,867	160,217	2,419	804,323	85,673	2,339	227
Landed at Boston in 1912	11,381,550	213,542	......	......	4,266,030	96,983	......	......	846,390	90,846	......	......
Landed at Gloucester in 1912	3,907,183	37,823	269,698	3,688	10,093,319	141,572	307,313	4,571	2,214,246	209,719	480,903	46,685

Month.	Mackerel.				Miscellaneous.[a]				Total.				Grand total.	
	Fresh.		Salted.		Fresh.		Salted.		Fresh.		Salted.			
	Pounds.	*Value.*	*Pounds.*	*Value.*	*Pounds.*	*Value.*	*Pounds.*	*Value.*	*Pounds.*	*Value.*	*Pounds.*	*Value.*	*Pounds.*	*Value.*
LANDED AT BOSTON.														
January	....	....	....	....	....	....	....	....	6,471,405	$236,937	....	....	6,471,405	$236,937
February	....	....	....	....	....	....	....	....	5,857,751	236,698	....	....	5,857,751	236,698
March	....	....	....	....	150,000	$3,750	....	....	6,959,625	210,277	....	....	6,959,625	210,277
April	....	....	....	....	....	....	....	....	8,213,180	200,582	....	....	8,213,180	200,582
May	....	....	....	....	....	....	....	....	5,737,455	144,708	....	....	5,737,455	144,708
June	1,329,300	$80,280	62,400	$3,690	140,400	15,325	5,000	$150	8,692,495	296,543	67,400	$3,840	8,759,895	300,383
July	757,900	41,393	19,400	576	1,282,750	103,893	....	....	9,517,435	329,547	19,400	576	9,536,835	330,123
August	1,050,160	66,342	36,600	2,121	664,400	48,688	....	....	10,040,360	322,584	36,600	2,121	10,076,960	324,705
September	227,028	14,712	4,400	235	626,628	33,588	....	....	9,729,232	321,568	4,900	245	9,734,132	321,813
October	344,500	18,573	3,000	180	354,775	7,478	....	....	8,863,505	288,335	20,750	726	8,884,255	289,061
November	8,391	1,528	....	....	419,771	8,784	....	....	7,208,953	209,435	....	....	7,208,953	209,435
December	1,172	465	....	....	198,519	6,433	....	....	4,911,148	183,830	....	....	4,911,148	183,830
Total	3,718,451	223,293	125,800	6,802	3,837,243	227,939	5,000	150	92,202,544	2,981,044	149,050	7,508	92,351,594	2,988,552
LANDED AT GLOUCESTER.														
January	....	....	....	....	1,351,250	37,159	4,402,060	71,354	2,913,764	104,985	5,082,758	101,866	7,996,522	206,851
February	....	....	....	....	87,500	2,406	120,000	3,000	1,301,145	74,227	253,565	8,722	1,554,710	82,949
March	....	....	....	....	....	....	114,000	1,875	1,868,837	81,751	317,701	11,342	2,186,538	93,093
April	....	....	....	....	....	....	....	....	4,674,274	131,228	236,436	10,892	4,910,710	142,120
May	1,880	150	400	20	109,800	1,647	128,000	2,560	5,511,776	130,306	1,912,283	73,135	7,424,059	203,441
June	43,200	2,114	259,000	15,540	609,200	5,955	....	....	3,645,251	77,543	2,791,731	110,718	6,436,982	188,261
July	17,410	1,292	137,000	9,280	443,000	3,318	....	....	3,989,594	79,450	3,749,210	150,388	7,738,804	229,838
August	6,480	462	266,000	17,954	19,536	591	....	....	3,124,169	70,098	1,754,262	74,383	4,878,431	144,481
September	19,980	2,103	299,000	21,958	525,320	4,464	1,400	35	2,933,408	62,241	2,576,866	135,664	5,510,274	197,905
October	454,175	20,198	169,000	13,187	519,000	5,286	....	....	2,403,212	55,783	1,890,309	91,473	4,293,521	147,256
November	25,669	2,297	127,200	9,877	28,800	1,466	885,624	15,843	5,373,766	87,217	3,275,797	123,324	8,649,563	210,541
December	5,357	541	....	....	190,600	6,686	4,025,692	65,251	4,028,544	72,623	4,256,534	75,106	8,285,078	147,729
Total	574,151	29,157	1,257,600	87,816	3,884,006	68,978	9,676,776	159,918	41,767,740	1,027,452	28,097,452	967,013	69,865,192	1,994,465
Grand total	4,292,602	252,450	1,383,400	94,618	7,721,249	296,917	9,681,776	160,068	133,970,284	4,008,496	28,246,502	974,521	162,216,786	4,983,017
Grounds E. of 66° west long	1,041,100	65,536	467,400	33,796	2,176,007	80,882	9,681,776	160,068	28,440,452	934,114	24,131,529	784,081	52,571,981	1,718,195
Grounds W. of 66° west long	3,251,502	186,914	916,000	60,822	5,545,242	216,035	....	....	105,529,832	3,074,382	4,114,973	190,440	109,644,805	3,264,822
Landed at Boston in 1912	2,496,620	148,496	143,000	9,442	1,909,890	163,530	....	....	100,157,080	2,721,949	143,000	9,442	100,300,080	2,731,391
Landed at Gloucester in 1912	163,620	9,390	1,405,000	101,010	9,081,150	200,547	10,005,252	181,814	51,263,695	1,055,295	31,140,284	992,573	82,403,979	2,047,868

[a] Includes herring from Newfoundland—1,778,750 pounds frozen, $49,965, and 9,675.376 pounds salted, $159,883.

QUANTITY AND VALUE OF CERTAIN FISHERY PRODUCTS LANDED AT BOSTON AND GLOUCESTER, MASS., BY AMERICAN FISHING VESSELS DURING THE CALENDAR YEAR 1913, SHOWN BY FISHING GROUNDS.

Fishing grounds.	Number of trips.	Cod.				Cusk.				Haddock.			
		Fresh.		Salted.		Fresh.		Salted.		Fresh.		Salted.	
		Pounds	*Value.*	*Pounds.*	*Value.*	*Pounds.*	*Value.*	*Pounds.*	*Value.*	*Pounds.*	*Value.*	*Pounds.*	*Value.*
LANDED AT BOSTON.													
East of 66° west longitude.													
La Have Bank	19	217,565	$7,912			209,375	$4,240			501,555	$13,640		
Western Bank	36	623,300	18,736			125,000	1,905			987,875	16,850		
Quereau Bank	8	326,800	7,548			22,000	390			11,500	340		
Green Bank	1												
Grand Bank	3			4,000	$180	3,000	60	3,000	$60				
Off Newfoundland	1												
Cape Shore	194	1,684,542	58,881			467,408	8,901			3,127,863	103,216		
Gulf of St. Lawrence	2	20,000	500										
St. Anns Bank	5	152,722	3,942							86,390	2,907		
West of 66° west longitude.													
Browns Bank	175	1,907,615	59,198			868,359	15,516			5,925,246	134,514		
Georges Bank	486	4,634,810	148,945			156,730	3,011			8,712,841	249,071		
Cashes Bank	12	69,488	2,942			56,965	1,124			22,213	567		
Clark Bank	1	12,000	480							40,000	1,200		
Fippenies Bank	18	77,549	2,552			72,787	1,294			48,645	1,751		
Tillies Bank	17	27,399	930			12,179	193			68,657	2,798		
Middle Bank	487	758,129	29,731			227,568	4,732			2,043,973	78,637		
Platts Bank	1	12,563	470			5,725	90			1,650	50		
Jeffreys Ledge	307	601,319	22,898			241,337	5,343			900,456	40,495		
Ipswich Bay	3	45	3										
South Channel	765	4,985,067	182,768			226,773	4,209			19,693,407	553,923	2,500	$75
Nantucket Shoals	83	1,370,193	47,058			72,000	1,440			541,860	14,687		
Off Highland Light	13	15,725	727			13,665	277			90,160	3,784		
Off Chatham	289	593,285	21,891			27,060	653			2,320,537	84,629		
Bay of Fundy	1												
Seal Island	2	7,047	182			8,135	106			37,382	982		
Shore, general	653	1,718,555	64,824			466,482	8,787			846,329	31,652		
Total	3,582	19,815,718	683,118	4,000	180	3,282,548	62,271	3,000	60	46,008,539	1,335,693	2,500	75

LANDED AT GLOUCESTER													
East of 66° west longitude.													
La Have Bank	35	265,224	5,485	54,505	2,307	587,875	8,451	21,550	470	344,145	4,669	3,570	54
Western Bank	89	2,474,635	49,647	327,800	13,224	574,503	8,320	13,790	310	1,171,727	11,564	4,352	66
Quereau Bank	48	518,564	10,717	1,076,731	44,797	31,430	480	2,745	61	37,012	396	21,875	343
Green Bank	28	29,985	630	166,875	7,643	7,030	92	1,951	45	......	......	525	8
Grand Bank	57	148,130	2,952	4,020,133	170,133	10,785	159	5,270	123	2,050	19	16,020	242
St. Peters Bank	2	1,780	40	21,080	902	......	......	90	2	......	......	270	4
Bacalieu Bank	3	8,750	168	17,595	721	......	......	40	1	......	......	......	......
Off Newfoundland	55	......	......	3,812,146	159,643	......	......	......	......	......	......	11,520	174
Cape North	28	1,330,302	25,401	2,086,063	79,039	27,065	379	620	14	54,200	494	20,605	309
Cape Shore	63	257,045	6,070	194,740	9,045	437,683	7,374	27,825	655	278,850	6,560	8,640	130
Gulf of St. Lawrence	23	141,100	2,722	472,968	19,187	960	14	270	6	......	......	1,285	19
St. Anns Bank	1	83,600	1,554	......	......	......	......	......	......	10,335	93	......	......
The Gully	5	28,740	601	38,247	1,665	9,645	142	125	3	730	7	......	......
Labrador Coast	8	......	......	599,113	21,558	......	......	......	......	......	......	......	......
West of 66° west longitude.													
Browns Bank	47	461,633	9,563	475,762	20,750	364,950	4,804	31,230	658	397,880	5,179	32,350	484
Georges Bank	181	1,648,892	34,518	2,319,824	102,016	273,561	3,693	35,041	774	2,531,703	26,093	113,357	1,724
Cashes Bank	7	20,665	419	......	......	68,862	968	......	......	9,540	86	......	......
Middle Bank	17	......	......	......	......	......	......	......	......	......	......	......	......
Ipswich Bay	85	......	......	......	......	......	......	......	......	......	......	......	......
South Channel	3	49,622	1,036	......	......	......	......	......	......	68,875	620	......	......
Nantucket Shoals	72	......	......	......	......	......	......	......	......	......	......	......	......
Off Chatham	1	......	......	......	......	......	......	......	......	......	......	......	......
Bay of Fundy	1	1,100	23	......	......	1,100	15	......	......	800	7	......	......
South	1	......	......	......	......	......	......	......	......	......	......	......	......
Shore, general	4,387	1,891,746	87,401	......	......	137,632	2,124	......	......	2,519,410	93,244	......	......
Total	5,247	9,361,513	238,947	15,683,582	652,630	2,533,141	37,015	140,547	3,122	7,427,257	149,031	234,369	3,557
Grand total	8,829	29,177,231	922,065	15,687,582	652,810	5,815,689	99,286	143,547	3,182	53,435,796	1,484,724	236,869	3,632

QUANTITY AND VALUE OF CERTAIN FISHERY PRODUCTS LANDED AT BOSTON AND GLOUCESTER, MASS., BY AMERICAN FISHING VESSELS DURING THE CALENDAR YEAR 1913, SHOWN BY FISHING GROUNDS—Continued.

Fishing grounds.	Hake.				Pollock.				Halibut.			
	Fresh.		Salted.		Fresh.		Salted.		Fresh.		Salted.	
	Pounds.	*Value.*	*Pounds.*	*Value.*	*Pounds.*	*Value.*	*Pounds.*	*Value.*	*Pounds.*	*Value.*	*Pounds.*	*Value.*
LANDED AT BOSTON.												
East of 66° west longitude.												
La Have Bank	93,045	$2,049			11,510	$297			82,232	$8,677		
Western Bank	59,040	1,561			31,100	694			156,076	13,686		
Quereau Bank	33,000	660			1,000	40			57,300	6,534		
Green Bank									70,000	6,100		
Grand Bank	9,230	128	3,000	$53					47,000	2,645		
Cape Shore	1,064,405	25,783			113,145	2,478			104,538	12,941		
Gulf of St. Lawrence									111,000	6,400		
St. Anns Bank	10,742	253			375	3			254	58		
West of 66° west longitude.												
Browns Bank	411,820	10,617			203,865	5,285			156,180	20,381		
Georges Bank	299,690	6,597			350,135	7,756			209,811	23,456		
Cashes Bank	89,499	1,822			8,690	179			4,390	408		
Clark Bank					1,000	30			200	20		
Fippenies Bank	147,865	3,275			14,815	315			5,002	532		
Tillies Bank	85,800	1,449			12,930	194			179	34		
Middle Bank	1,244,700	35,308	5,000	175	578,928	11,804			7,556	1,075		
Platts Bank	9,975	152			2,060	31			21	3		
Jeffreys Ledge	783,602	22,549			1,157,125	27,151			5,922	803		
Ipswich Bay					24,295	697						
South Channel	2,817,894	62,493			727,830	15,055			73,949	8,948		
Nantucket Shoals	51,820	653			75,840	1,526			300	30		
Off Highland Light	24,880	719			5,805	228			213	53		
Off Chatham	261,565	8,505			82,425	2,582			3,891	548		
Seal Island	3,758	49			800	13			591	88		
Shore, general	2,617,830	51,810	500	10	912,792	21,678	250	$3	7,315	842		
Total	10,119,660	236,432	8,500	238	4,316,465	98,036	250	3	1,103,920	114,262		

LANDED AT GLOUCESTER.												
East of 66° west longitude.												
La Have Bank	744,022	7,899	4,685	71	36,290	295	11,280	170	256,134	22,779	50	4
Western Bank	539,680	5,423	9,892	151	107,696	892	9,870	148	443,541	33,772	229	21
Quereau Bank	193,215	2,143	62,655	1,060	6,300	52	11,380	169	504,321	47,853	8,426	833
Green Bank	12,563	159	10,855	171	935	8	920	14	378,041	40,632	1,613	161
Grand Bank	117,965	1,304	132,582	2,103	730	6	18,164	273	701,588	49,515	12,964	1,184
St. Peters Bank			200	3	75	1			93,632	4,903		
Bacalieu Bank			60	1					167,723	8,404	13,625	1,192
Off Newfoundland			1,375	21			745	11			420	40
Cape North	144,435	1,313	32,610	489	10,430	83	16,580	248	9,264	511	8,383	736
Cape Shore	352,112	4,525	53,895	987	23,257	246	4,397	71	220,414	23,641	3,336	334
Gulf of St. Lawrence	87,860	790	7,340	111	2,630	21	2,155	33	448,080	24,961	41,571	3,656
St. Anns Bank					1,300	10						
The Gully	22,185	216					525	8	101,100	9,184		
Labrador Coast											438,637	42,547
West of 66° west longitude.												
Browns Bank	84,340	787	4,570	70	34,570	303	41,410	620	74,170	8,834	190	16
Georges Bank	87,480	975	7,663	121	119,536	1,031	117,452	1,779	254,633	19,618	2,149	211
Cashes Bank	147,920	1,355			2,370	20						
South Channel					2,445	19						
Nantucket Shoals					96,190	770						
Bay of Fundy	34,000	306			1,200	10						
Shore, general	1,052,551	22,565	8,620	115	10,268,749	156,190	1,105	17				
Total	3,620,328	49,760	337,002	5,474	10,714,703	159,957	235,983	3,561	3,652,641	294,607	531,593	50,935
Grand total	13,739,988	286,192	345,502	5,712	15,031,168	257,993	236,233	3,564	4,756,561	408,869	531,593	50,935

QUANTITY AND VALUE OF CERTAIN FISHERY PRODUCTS LANDED AT BOSTON AND GLOUCESTER, MASS., BY AMERICAN FISHING VESSELS DURING THE CALENDAR YEAR 1913, SHOWN BY FISHING GROUNDS—Continued.

Fishing grounds.	Mackerel.				Miscellaneous.				Total.				Grand total.	
	Fresh.		Salted.		Fresh.		Salted.		Fresh.		Salted.			
	Pounds.	*Value.*	*Pounds.*	*Value.*	*Pounds.*	*Value.*	*Pounds.*	*Value.*	*Pounds.*	*Value.*	*Pounds.*	*Value.*	*Pounds.*	*Value.*
LANDED AT BOSTON.														
East of 66° west longitude.														
La Have Bank					12,700	$225			1,127,982	$37,040			1,127,982	$37,040
Western Bank					30,100	2,106			2,012,491	55,538			2,012,491	55,538
Quereau Bank					4,900	124	5,000	$150	456,500	15,636	5,000	$150	461,500	15,786
Green Bank									70,000	6,100			70,000	6,100
Grand Bank									59,230	2,833	10,000	293	69,230	3,126
Off Newfoundland					a 150,000	3,750			150,000	3,750			150,000	3,750
Cape Shore	1,028,500	$64,906	59,400	$3,540	346,967	28,373			7,937,368	305,479	59,400	3,540	7,996,768	309,019
Gulf of St. Lawrence									131,000	6,900			131,000	6,900
St. Anns Bank					1,840	25			252,323	7,188			252,323	7,188
West of 66° west longitude.														
Browns Bank					71,940	5,277			9,545,025	250,788			9,545,025	250,788
Georges Bank					1,956,647	151,408			16,320,664	590,244			16,320,664	590,244
Cashes Bank					7,080	112			258,325	7,154			258,325	7,154
Clark Bank									53,200	1,730			53,200	1,730
Fippenies Bank					10,330	238			376,993	9,957			376,993	9,957
Tillies Bank					8,144	165			215,288	5,763			215,288	5,763
Middle Bank	309,339	16,890			112,686	2,489			5,282,879	180,666	5,000	175	5,287,879	180,841
Platts Bank									31,994	796			31,994	796
Jeffreys Ledge					55,734	1,264			3,745,495	120,503			3,745,495	120,503
Ipswich Bay					840	48			25,180	748			25,180	748
South Channel	31,250	3,287	14,000	1,064	807,852	19,525			29,363,522	850,208	16,500	1,139	29,380,022	851,347
Nantucket Shoals	266,488	18,967	4,400	235	27,815	381			2,406,316	84,742	4,400	235	2,410,716	84,977
Off Highland Light	483	189			1,420	33			152,351	6,010			152,351	6,010
Off Chatham	1,269,800	78,993	22,600	1,057	6,649	203			4,565,212	198,004	22,600	1,057	4,587,812	199,061
Bay of Fundy					14,400	1,426			14,400	1,426			14,400	1,426
Seal Island									57,713	1,420			57,713	1,420
Shore, general	812,591	40,061	25,400	906	209,199	10,767			7,591,093	230,421	26,150	919	7,617,243	231,340
Total	3,718,451	223,293	125,800	6,802	3,837,243	227,939	5,000	150	92,202,544	2,981,044	149,050	7,508	92,351,594	2,988,552

LANDED AT GLOUCESTER.														
East of 66° west longitude.														
La Have Bank	....	....	....	....	290	23	....	....	2,233,980	49,601	95,640	3,076	2,329,620	52,677
Western Bank	....	....	....	....	....	....	....	....	5,311,782	109,618	365,933	13,920	5,677,715	123,538
Quereau Bank	....	....	....	....	....	....	....	....	1,290,842	61,641	1,183,812	47,263	2,474,654	108,904
Green Bank	....	....	....	....	....	....	....	....	428,614	41,521	182,739	8,042	611,353	49,563
Grand Bank	....	....	....	....	460	41	....	....	981,708	53,996	4,205,133	174,058	5,186,841	228,054
St. Peters Bank	....	....	....	....	....	....	....	....	95,487	4,944	21,640	911	117,127	5,859
Bacalieu Bank	....	....	....	....	....	....	....	....	176,473	8,572	31,320	1,915	207,793	10,487
Off Newfoundland	....	....	....	....	a1,628,750	46,215	a 9,675,376	159,883	1,628,750	46,215	13,501,582	319,772	15,130,332	365,987
Cape North	....	....	....	....	....	....	....	....	1,575,696	28,181	2,164,861	80,835	3,740,557	109,016
Cape Shore	12,600	630	259,000	15,540	....	....	....	....	1,581,961	49,046	551,833	26,762	2,133,794	75,808
Gulf of St. Lawrence	....	....	149,000	14,716	....	....	....	....	680,630	28,508	674,589	37,728	1,355,219	66,236
St. Anns Bank	....	....	....	....	....	....	....	....	95,235	1,657	....	....	95,235	1,657
The Gully	....	....	....	....	....	....	....	....	162,400	10,150	38,897	1,676	201,297	11,826
Labrador Coast	....	....	....	....	....	....	a 1,400	35	....	....	1,039,150	64,140	1,039,150	64,140
West of 66° west longitude.														
Browns Bank	....	....	....	....	540	54	....	....	1,418,083	29,524	585,512	22,598	2,003,595	52,122
Georges Bank	....	....	....	....	6,796	622	....	....	4,922,601	86,550	2,595,486	106,625	7,518,087	193,175
Cashes Bank	....	....	....	....	....	....	....	....	249,357	2,848	....	....	249,357	2,848
Middle Bank	50,350	2,506	113,800	6,282	....	....	....	....	50,350	2,506	113,800	6,282	164,150	8,788
Ipswich Bay	386,800	16,228	....	....	519,000	5,286	....	....	905,800	21,514	....	....	905,800	21,514
South Channel	....	....	....	....	....	....	....	....	120,942	1,675	....	....	120,942	1,675
Nantucket Shoals	34,920	3,360	664,000	46,923	2,100	252	....	....	133,210	4,382	664,000	46,923	797,210	51,305
Off Chatham	....	....	4,600	403	....	....	....	....	....	....	4,600	403	4,600	403
Bay of Fundy	....	....	....	....	....	....	....	....	38,200	361	....	....	38,200	361
South	....	....	400	20	....	....	....	....	....	....	400	20	400	20
Shore, general	89,481	6,433	66,800	3,932	1,726,070	16,485	....	....	17,685,639	384,442	76,525	4,064	17,762,164	388,506
Total	574,151	29,157	1,257,600	87,816	3,884,006	68,978	9,676,776	159,918	41,767,740	1,027,452	28,097,452	967,013	69,865,192	1,994,465
Grand total	4,292,602	252,450	1,383,400	94,618	7,721,249	296,917	9,681,776	160,068	133,970,284	4,008,496	28,246,502	974,521	162,216,786	4,983,017

[a] Herring. Other items under "Miscellaneous" include bluebacks, 1,660,600 pounds, value $14,187; butterfish, 46,167 pounds, value $1,192; catfish or wolffish, 5,026 pounds, value $151; flounders, 400,314 pounds, value $13,334; herring, 291,700 pounds, value $3,738; redfish, 15,963 pounds, value $276; shad, 308,020 pounds, value $4,215; sharks, 3,505 pounds; value $68; skates, 8,705 pounds, value $141; swordfish, fresh, 2,375,920 pounds, value $195,727; swordfish, salted, 5,000 pounds, value $150; livers, 751,950 pounds, value $9,343, sounds, 63,665 pounds, value $3,809; and spawn, 10,964 pounds, value $771.

As regards the sources of the fish on which this large industry depends, it may be noted that 67.52 per cent of the quantity and 65.45 per cent of the value were obtained from fishing grounds lying directly off the coast of United States; 13.28 per cent of the quantity and 13.5 per cent of the value from fishing banks off the coast of Newfoundland; 18.55 per cent of the quantity and 19.75 per cent of the value from grounds off the Canadian Provinces; and less than 1 per cent of the quantity and 1.28 per cent of the value from the coast of Labrador. Newfoundland herring constituted 7.06 per cent of the quantity and 4.21 per cent of the value of the products of the vessel fisheries of these ports. The herring were taken on the treaty coast of Newfoundland, but cod and other species from that region were obtained chiefly from fishing banks on the high seas. The fish caught by American fishing vessels off the Canadian Provinces were all from offshore fishing grounds. The catch from each of these fishing regions is given in detail in the following table:

QUANTITY AND VALUE OF FISH LANDED BY AMERICAN FISHING VESSELS AT BOSTON AND GLOUCESTER, MASS., IN 1913, FROM GROUNDS OFF THE COASTS OF THE UNITED STATES, NEWFOUNDLAND, AND CANADIAN PROVINCES.

Species.	United States.		Newfoundland.[a]		Canadian Provinces.		Total.	
	Pounds.	*Value.*	*Pounds.*	*Value.*	*Pounds.*	*Value.*	*Pounds.*	*Value.*
Cod:								
Fresh	20,856,300	$718,354	188,645	$3,790	8,132,286	$199,921	29,177,231	$922,065
Salted	2,795,586	122,766	8,640,942	360,780	4,251,054	169,264	15,687,582	652,810
Cusk:								
Fresh	3,292,635	58,258	20,875	311	2,502,179	40,717	5,815,689	99,286
Salted	66,271	1,432	10,351	231	66,925	1,519	143,547	3,182
Haddock:								
Fresh	46,783,382	1,322,980	2,050	19	6,650,364	161,725	53,435,796	1,484,724
Salted	148,207	2,283	28,335	428	60,327	921	236,869	3,632
Hake:								
Fresh	10,218,731	231,631	139,758	1,591	3,381,499	52,970	13,739,988	286,192
Salted	26,353	491	148,072	2,352	171,077	2,869	345,502	5,712
Pollock:								
Fresh	14,682,395	252,844	1,740	15	347,033	5,134	15,031,168	257,993
Salted	160,217	2,419	19,829	298	56,187	847	236,233	3,564
Halibut:								
Fresh	803,732	85,585	1,457,984	112,199	2,494,845	211,085	4,756,561	408,869
Salted	2,339	227	467,259	45,124	61,995	5,584	531,593	50,935
Mackerel:								
Fresh	3,251,502	186,914	....	....	1,041,100	65,536	4,292,602	252,450
Salted	916,000	60,822	....	....	467,400	33,796	1,383,400	94,618
Herring:								
Fresh	291,700	3,738	1,778,750	49,965	....	....	2,070,450	53,703
Salted	....	....	9,676,776	159,918	....	....	9,676,776	159,918
Swordfish:								
Fresh	2,039,323	164,571	460	41	336,137	31,115	2,375,920	195,727
Salted	....	....	....	....	5,000	150	5,000	150
Miscellaneous:								
Fresh	3,199,819	46,300	....	....	75,060	1,187	3,274,879	47,487
Total	109,534,492	3,261,615	22,581,826	737,062	30,100,468	984,340	162,216,786	4,983,017

[a] Includes 599,113 pounds of salted cod, valued at $21,558; 438,637 pounds of salted halibut, valued at $42,547; and 1,400 pounds of salted herring, valued at $35, from the Labrador coast.

The most interesting and uncertain of the New England vessel fisheries is the mackerel. The catch may be said to have been a failure since 1886, for in no year since then has the yield even approximated that of the preceding years. In 1913 there was some improvement over the previous year, and the catch amounted to 48,126 barrels sold fresh and 7,809 barrels salted. The southern fishery in the spring of 1914 was comparatively successful; and up to June 30 there was a decided improvement over the corresponding period of 1913. The netters fishing on the shores of the United States and the seiners resorting to the shores of Nova Scotia had a fairly successful season. In June a prominent feature of the fishery was the taking of small mackerel in much larger quantities than for a number of years along the entire coast from Cape Cod to Portland.

Swordfish were more plentiful in 1913 than usual. The entire swordfish fleet did well, and some of the vessels made large catches. On July 4 the schooner *Topsail Girl* landed 242 swordfish, the result of three weeks' fishing, probably the largest number of fish of this species ever brought in by one vessel in one trip; but this record was exceeded on August 4, when the schooner *Edmund F. Black* landed 274 swordfish. The principal fishing ground for vessels in this fishery from Massachusetts and Maine ports is Georges Bank, although large numbers of swordfish are taken along the entire coast from Block Island to the Strait of Canso. The season for this fishery is chiefly from June to September, and Boston is the principal market for the catch. The quantity of swordfish landed at Boston and Gloucester by American fishing vessels in 1913 was 2,375,920 pounds fresh, valued at $195,727, and 5,000 pounds salted, valued at $150. Nearly all of the vessels in this fishery are fitted with auxiliary power, which enables them to fish over a large area. The apparatus used is a harpoon.

The winter gill-net fishery, which is carried on at Gloucester and a few other ports on the New England coast, employed about 40 vessels, practically the same number as in 1913. In the early part of the season, i. e., in October and November, the fleet was very successful, large quantities of pollock being taken in a comparatively short time. The catch of cod and haddock by this method, however, was small, and in consequence a number of vessels abandoned the fishery early in the spring. Although a few vessels did fairly well, the fishery as a whole did not compare favorably with the previous year.

The otter-trawl fishery, which centers at Boston, was carried on with greater activity than in previous years. Three new steamers have been added to the fleet since July, 1913, increasing the number to 9, in addition to which one vessel operating out of New York sometimes landed her catch at Boston. The number of trips made by the otter trawlers in 1913 was 326, an increase of 31 over the previous year. The total amount of fish landed at Boston was 14,366,283 pounds, against 15,025,150 pounds landed in 1912, a decrease of 658,867 pounds. The fishery, as in previous years, was chiefly confined to Georges and the South Channel, although during the spring months a number of trips were taken on the Western Bank and a portion of the catch was landed at Portland, Me. The French fleet of otter trawlers, operating on Grand Bank, St. Pierre Bank, and Quereau Bank, consisted of about 30 steamers.

The operations of the Boston trawlers, which had been under investigation during the previous year, were again subjected to close scrutiny, and during the first half of the fiscal year agents of the Bureau were constantly engaged in recording the large and small fish, marketable and unmarketable, taken at each haul of the net. The field work was suspended in December, although much desirable information still remained to be gathered; and a special committee of Bureau assistants was formed for the purpose of considering the data in hand and of making a general report on the subject of otter trawling. The preparation of the report, for which there has been an insistent demand ever since the investigation began, will be pushed as rapidly as possible.

The new fish pier at Boston, the construction of which was begun in 1912, has been completed, and the 44 fresh-fish firms at T Wharf, where the fresh-fish trade has been carried on for the past 30 years, moved to the new pier on March 29, 1914. The pier is 1,200 feet long and 300 feet wide, and has connected with it a cold-storage plant with a capacity of 1,000,000 pounds of fish. There is also an ice plant from which manufactured ice, either crushed or in cakes, is furnished to the dealers and vessels as needed, being conveyed on motor trucks. The pier is equipped with the latest improvements for conducting the fresh-fish business, and a much greater quantity of fish can be handled daily than was possible at T Wharf. This pier, the best of the kind in the Western Hemisphere, is the most noteworthy improvement in the New England fishing industry in recent years.

MENHADEN INDUSTRY.

The great abundance of menhaden in the coastal waters of the Atlantic seaboard and the peculiar qualities of the fish led many years ago to the inauguration of an industry which in time became an important branch of our fisheries. The taking of menhaden for conversion into oil and fertilizer is now carried on from Maine to Florida, and ranks as one of the leading fisheries of the country. Menhaden caught incidentally in the shore fisheries are utilized also in large quantities as bait in the line fisheries for cod, mackerel, bluefish, and other species, and smaller quantities are used as human food.

A special investigation and statistical canvass of the menhaden industry was undertaken in 1913, and full data for the previous calendar year were obtained by agents who visited every fishing center and every factory. No detailed or complete information had been collected for five years, and no general report on the subject had been issued for many years preceding. Meanwhile, popular interest in the fishery has grown, and local opposition has continued because of a belief that, in fishing for menhaden, great injury is done to other fishes associated with or predatory upon the menhaden.

From the table which follows, it will be seen that in 1912 the menhaden industry gave employment to 3,735 fishermen and 2,159 persons on shore, who received $1,579,000 in wages. The vessels used numbered 118 steamers and 29 gasoline motors, and 274 purse seines, valued at $271,000, constituted the sole means of capture. There were in operation 48 factories, a majority of them located in Virginia and North Carolina. The total investment in floating and shore property was over $7,908,000.

The number of menhaden utilized in the factories was over one billion, valued at $2,210,000. This catch, which weighed 637 million pounds, was larger than in any previous year for which statistics are available, and may be regarded as marking a climax, because the following season showed a decided decrease in the available supply of menhaden and a corresponding drop in the product. In addition to the menhaden, about 5 million pounds of sharks, skates, and other waste species caught in the seines, and alewives and other fishes bought from boat fishermen, were consumed at the factories.

The manufactured products consisted of 6,651,000 gallons of oil, valued at $1,552,000, and over 88,000 tons of scrap, valued at over $2,100,000.

The vessels engaged in the menhaden fishery consist of steamers, auxiliary schooners, and gasoline boats. The steamers are built somewhat on the tug model, with high bow. The living quarters are forward, while the engine, boilers, and coal bunkers are aft, and the hold is in the center where the deck is low so as to facilitate the transfer of the fish from the net. The auxiliary schooners, most of which are owned in North Carolina, have practically the same arrangement. Many of the steamers now in use are lighted with electricity and have searchlights. The largest one in use in 1912 has a carrying capacity of over a million fish, while a larger one built in 1913, at a cost of $100,000, has a carrying capacity of one and a half million fish, or 4,500 barrels. The largest gasoline fishing boat is owned in New Jersey, and has a carrying capacity of 400,000 fish. There were 27 steamers built in 1911 and 1912, and several others were in course of construction in 1913. The seine boats are built mostly of cedar, and are 28 to 33 feet long, 6 to 7 feet beam, 2 feet to 2 feet 10 inches deep, and cost $275 to $400 each.

The purse seines are generally about 135 to 200 fathoms long, 9 to 10 fathoms deep, with 1¾-inch stretched mesh. The "bunt" or center, which is 400 to 500 meshes square, is made of No. 15 and No. 18 cotton twine. The other parts are made of No. 20–9 and No. 20–12 twine. The cork and lead lines are 9 and 12 thread manila rope, and the purse line is 36 thread Russian hemp. The brass rings through which the purse line passes are 4 inches in diameter, and weigh 1½ pounds each; they are attached to the lead line by beckets from 6 to 12 inches long, and are from 3½ to 5 fathoms apart; and the final rings are placed about 10 fathoms from the ends of the net. The corks are 3 to 4½ inches in diameter; the larger ones being placed in the center of the seine in groups of three or four close together. Each seine has from 2,200 to 3,200 corks, costing from $30 to $45 a thousand. The cork and lead lines of the seine are tarred, but not the purse line; the net is also tarred once when new.

The method of preserving the seine during the fishing season is by the use of salt. After the day's fishing the seine is stowed in the seine boats, and about 4 bushels of coarse salt are sprinkled over each arm or portion of the seine in each boat. From 12 to 15 buckets of sea water are then poured over the netting in each boat, and as this collects in the bottom of the boats it is pumped into buckets and poured over the twine. This is repeated several times a day while the seine remains in the boats. When the twine is very slimy, as is frequently the case after a haul has been made, it is washed by a stream of water from the fire hose of the steamer. The seines completely rigged for fishing cost about $1,000 each, and are seldom used more than one season.

The menhaden factories are usually two-story buildings, and are so located as to be accessible to the steamers engaged in the fishery. In addition to the main factory there are several other buildings, including the office, "scrap room" in which the scrap is bagged and stored for shipment, the mess house, and the sleeping quarters for the men. Some of the factories built in recent years have cement floors; many of them are lighted with electricity generated on the premises, and one plant is supplied with electric motors for operating the machinery. The equipment of an average factory consists of an elevator for hoisting the fish out of the vessels, a measuring device, a "raw box," a cooker, presses, a drier, oil tanks, and bucket, chain, or screw conveyors for moving the material from one part of the plant to another. The elevator or other device for removing the fish from the hold of the steamer, and the device for measuring the fish, are always placed on the outer end of the wharf. The cooker is generally on the ground floor, but at some factories is not in the building but on the outside, with a roof to protect it from the weather. The presses are generally placed on the second floor, and the oil tanks at a lower level, so that the oil and water coming from the presses may have a gravity flow. The tanks are frequently outside of the building with no covering, but in most of the northern factories they are under a roof. The drier is on the ground floor, either in the main building or under a shed. The power of the boilers and engines depends on the equipment of the factory. Two 125-horsepower boilers, costing about $1,500 each, are sufficient for a plant having one cooker, two presses, and one drier. The cost of the entire equipment of such a plant is about $24,000, and the capacity is about 600,000 fish in a day of 12 hours. The largest factory on the coast has a capacity of about 2,500,000 fish a day and employs upward of 200 men.

The principal processes involved in the manufacture of menhaden oil and fertilizer are cooking and pressing the fish, and drying or otherwise preserving the scrap. It is desirable to cook the fish as soon as practicable after they are caught. Cooking was formerly done almost entirely in vats or tanks fitted at the bottom with perforated pipes by means of which steam was supplied to heat the water in which the fish were placed. The usual time for cooking the fish in these tanks is about 20 minutes. In recent years continuous steam cookers, in which the cooking is done by direct steam, have been gradually displacing the old style vats, and the latter are now used only in North Carolina. After the fish are cooked, the oil is pressed from them by either hydraulic or screw presses. The old-style curbs and hydraulic presses have been displaced to a considerable extent by the screw presses, but are still in use in a number of factories. In drying the scrap it was formerly the custom to spread it on a platform made of boards or concrete where it was exposed to the action of the sun for several days until dry. This method is still employed to some extent, but the hot-air drier is now generally used. Several of the factories have as adjuncts plants for the preparation of fish fertilizer, but the greater part of the scrap is sold to the fertilizer mixing plants. The oil is practically all sold to the dealers in New York, New Bedford, Baltimore, and Boston, where it is refined and graded.

MENHADEN INDUSTRY OF THE ATLANTIC COAST STATES IN 1912.

Items.	Connecticut and New York.[a]		New Jersey and Delaware.		Virginia.[b]		North Carolina and Florida.		Total.	
PERSONS AND WAGES.										
Persons engaged:	*Number.*	*Value.*	*Number.*	*Value.*	*Number.*	*Value.*	*Number.*	*Value.*	*Number.*	*Value.*
In offices and factories	576		317		1,010		256		2,159	
On vessels fishing	1,094		357		1,820		464		3,735	
Total	1,670		674		2,830		720		5,894	
Wages paid:										
In offices and factories		$234,711		$78,228		$198,737		$49,158		$560,834
On vessels fishing		398,218		112,769		426,832		80,331		1,018,150
Total		632,929		190,997		625,569		129,489		1,578,984
INVESTMENT.										
Cash or working capital		101,679		93,184		197,842		78,700		471,405
Factories	8	1,400,119	7	509,401	20	1,307,128	13	409,335	48	[c] 3,625,983
Vessels:										
Steam	39	1,103,500	12	338,000	62	1,737,592	5	124,200	118	3,303,292
Net tonnage	3,984		1,262		6,970		729		12,945	
Gasoline			2	25,000	1	2,000	26	126,500	29	153,500
Net tonnage			26		33		562		621	
Purse seines	78	78,000	35	34,000	121	123,000	40	36,000	274	271,000
Seine and striker boats	117	26,015	42	9,010	189	37,335	38	10,775	386	83,135
Total		2,709,313		1,008,595		3,404,897		785,510		7,908,315
EXPENSES.										
Taxes and insurance		51,473		30,311		65,064		7,582		154,430
Subsistence of employees		141,232		35,786		154,266		13,641		[d] 344,925
Fuel		128,323		34,663		200,333		40,688		[d] 404,007
Shipping packages		58,813		29,772		51,836		4,779		145,200
Acids		6,115		3,946				750		10,811
Total		385,956		134,478		471,499		67,440		1,059,373

[a] Includes 1 factory in Maine operated only a few weeks during 1912 and a floating factory now dismantled, both owned by a New York company.
[b] Includes 1 small factory in Maryland.
[c] Includes buildings, grounds, wharves, machinery, horses, wagons, and small boats used about the factories.
[d] Total for factories and vessels.

Menhaden Industry of the Atlantic Coast States in 1912—Continued.

Item.	Connecticut and New York.[a]		New Jersey and Delaware.		Virginia.[b]		North Carolina and Florida.		Total.	
FISH HANDLED AT FACTORIES.										
Menhaden:	*Number.*	*Value.*	*Number.*	*Value.*	*Number.*	*Value.*	*Number.*	*Value.*	*Number.*	*Value.*
Caught by own vessels	307,708,000	$687,869	108,935,800	$232,242	471,421,000	$987,146	68,952,500	$95,903	957,017,300	$2,003,160
Bought from other vessels	9,507,300	17,034	28,581,600	56,928	38,740,050	76,614	14,393,500	28,351	91,222,450	178,927
Bought from shore or boat fisheries	190,400	336	11,000,000	24,050	900,000	1,800	1,513,600	1,892	13,604,000	28,078
Total	317,405,700	705,239	148,517,400	313,220	511,061,050	1,065,560	84,859,600	126,146	[c] 1,061,843,750	2,210,165
Other species:										
Scrap fish and alewife cuttings . . pounds					4,900,000	59,404			[d] 4,900,000	59,404
Sea robins . . do	30,000	68							30,000	68
Skates and swellfish . . do	150,000	225							150,000	225
Sharks . . do							16,000	50	16,000	50
Total	180,000	293			4,900,000	59,404	16,000	50	5,096,000	59,747
Grand total		705,532		313,220		1,124,964		126,196		2,269,912
MANUFACTURED PRODUCTS.										
Oil . . gallons	3,613,500	838,216	957,337	247,831	1,907,083	426,948	173,283	38,995	6,651,203	1,551,990
Dry scrap . . tons	2,242	68,255	2,923	91,740	40,255	1,208,321	5,465	164,678	50,885	1,532,994
Acidulated scrap . . do	26,132	416,048	9,744	158,874			1,660	28,524	37,536	603,446
Crude or green scrap . . do			99	1,725					99	1,725
Total		1,322,519		500,170		1,635,269		232,197		3,690,155

[a] Includes 1 factory in Maine operated only a few weeks during 1912 and a floating factory now dismantled, both owned by a New York company.
[b] Includes 1 factory in Maryland.
[c] 637,106,250 pounds.
[d] Consists chiefly of alewife cuttings from packing houses; scrap fish are alewives and perch bought from pound-net fishermen.

STURGEON FISHERY OF DELAWARE RIVER.

A special inquiry regarding the sturgeon and sturgeon fishery of the Delaware River was made by the Commissioner in June, 1914. Notwithstanding a tremendous decline from the conditions prevailing between 1890 and 1900, the Delaware continues to be the leading sturgeon stream of the country.

The fishing centers at Delaware City, Del., and the active season is from about May 25 to July 1. Some sturgeon with large roe are caught as late as September, but a large proportion of such fish are of the small species (*Acipenser brevirostris*) locally called "bottlenose."

In 1914 the fishery was conducted by 135 boats, each carrying 2 men and a gill net. A sturgeon boat, with net and other equipment, is valued at $400. The boats belonged in three States, 59 being in Delaware, 69 in New Jersey, and 7 in Pennsylvania. The largest number of boats hailed from Port Penn, Del., but Bayside, Pennsville, and Pennsgrove, N. J., and Delaware City and Cedar Creek, Del., also had good-sized fleets.

The season of 1914 was the best in five to seven years, and, according to local fishermen, the conditions affecting the fishery are gradually improving owing to the discontinuance of early fishing at the Capes of the Delaware and in the lower bay and to protective legislation affecting the fishing in the river. This has permitted a fair percentage of the fish to reach the spawning grounds; and in 1914, up to the first of June, from 50 to 60 per cent of the cow sturgeon caught were spent.

The sturgeon is now so valuable that a boat which takes 6 to 10 fish in a season will pay expenses. In 1914, the price of roe, after being put through a sieve or "rubbed out," averaged $1.50 a pound and ranged as high as $1.75 a pound. The carcass, after decapitation, skinning, and evisceration, brought 12 to 20 cents a pound.

A fish brought into Delaware City on May 22, 1914, produced 86 pounds of rubbed-out roe and netted the fisherman $179.82; and another taken on the same day had 80 pounds of roe and sold for $145.50. On May 28 a Delaware City fisherman caught a fish 12 feet 3 inches long that weighed 450 pounds gross; the ovaries weighed 125 pounds, and the screened roe weighed 99½ pounds. This fish, which was of exceptionally large size for recent years, brought the fisherman $178. Another fish taken on the same day had 85½ pounds of roe.

There now exists among the Delaware River fishermen a strong sentiment in favor of adequate protection for the sturgeon.

CONDITION OF THE NORTH CAROLINA FISHERIES.

In view of the active cooperation which for many years has existed between the Bureau of Fisheries and the North Carolina officials having charge of fishery matters, and because of the aid which has been given to the local fisheries by the work of artificial propagation on Albemarle Sound and tributaries, a brief review of the situation is appropriate at this time.

The history of the fisheries of North Carolina is similar to that of most other communities in which the regulation of the industry has been in obedience to local demands, prejudices, and jealousies rather than based on broad principles having in view the interests of the State as a whole and a proper regard for the future welfare of both the fisherman and the consumer. There was at first a gradual increase in the yield, owing to the growth of markets and the improvement of means of transportation, the demand thus stimulated resulting in an increase in the number of persons and the quantity of apparatus employed. For a period this increase in the intensity of the fishery had no very conspicuous influence on the apparent abundance of the fishes, the effects being further obscured in the view of the fishermen by an increase in the unit price of the products, due to broader markets. Eventually, however, the decrease in the fishes began to manifest itself in the catch, and this was most conspicuous in the more desirable and higher-priced species like the shad. From 1880, the earliest year for which data are available, the catch of this species gradually increased under the operation of the factors just mentioned, but after attaining a maximum about 1897 it declined rapidly and in 1904 had sunk to the level of 1880. Essentially the same conditions obtained with respect to other species, although the catch of food fish as a whole was well maintained because many of the cheaper fish, justly or unjustly regarded as inferior, which in the earlier period were but little utilized, at a later date came into greater demand and found a market which the fishermen could supply with profit.

About the time the decrease in the shad became critical and was imposing a serious decrease in the profits of the fishermen, an inquiry was instituted by the Bureau of Fisheries which demonstrated that the most important, if not practically the sole, cause of the decrease was the excessive use of fishing apparatus of all kinds, fished promiscuously in the inlets, channels, and sounds so as to effectually block the passage of the shad and other anadromous fishes to their spawning grounds.

Moved by a consideration of these facts, the legislature of North Carolina, in 1905, passed an act, popularly known as the Vann bill, which prohibited fishing in certain of the inlets leading from the sea to the sounds, and restricted the use of pound nets in the upper part of Pamlico Sound and all of Croatan, Roanoke, and Albemarle Sounds to certain prescribed zones. As amended in 1909, this law now preserves from all nets a strip of varying width extending from the ocean inlets to and up the rivers discharging into Albemarle Sound.

There is thus created a broad avenue in which the shad and other anadromous fishes may travel without obstruction from the sea to their spawning places in the rivers. The effect of this has become increasingly apparent and perhaps may be illustrated best by the history of the operations of the Bureau's hatchery at Edenton, N. C., at the end of Albemarle Sound. The station was established in 1889 for the utilization of the eggs from shad resorting to the spawning beds in Chowan River and the adjacent parts of the sound. Its first year of effective operation was 1901, when 75,400,000 eggs were taken. In 1902 the take fell to 37,987,000, and by 1905 the number of eggs secured had fallen by stages to 6,748,000. In 1906, the year in which the Vann bill became effective, 25,643,000 eggs were taken; in 1909 the take was 59,685,000; in 1913 it had risen by rapid stages to 138,912,000, and even this number could have been exceeded if the capacity of the hatchery at that time had permitted the eggs to be handled. The season of 1914 showed a temporary decline owing to unfavorable weather conditions.

The shad fishery in Albemarle Sound in 1913 was generally said to be the greatest for many years, if not in the history of the locality. The facts are a vindication of both rational legislation and shad culture. The hatchery was ineffective so long as the fish were prevented from reaching the spawning beds where ripe eggs may be obtained, but as soon as an unobstructed way was opened by the enforcement of a reasonable law, its operations could be conducted on a scale sufficient to warrant expectation of economic results. The effects of the heavier plants of recent years are in turn manifested both in the increase in the product of the fishery and in the number of eggs obtainable.

Fortified by the conspicuously good effects which followed the passage of the Vann law, the friends of fishery conservation in North Carolina have been endeavoring to have its essential features extended to all maritime parts of the State, and the movement to that end has been supported and aided by the Bureau. In 1906 a canvass of the shad fisheries of the State was made by an agent of the Bureau, and practically every year since then an assistant has been detailed to assist and advise in the campaign which has been waged. Although the desired legislation has not been enacted, each year has shown a greater willingness of the fishery interests of most parts of the State to break away from the ineffective and pernicious system of county control and special local regulation, and to adopt the broad principles of State administration, without which no effective laws can be drafted or enforced.

FRESH-WATER MUSSEL FISHERY.

A general canvass of the fresh-water mussel fishery has been undertaken, and during the year waters tributary to the Gulf of Mexico from the Ohio River southward were covered for the calendar year 1912. This fishery supplies the raw materials used in the pearl-button industry and yields also pearls. Nearly all the shells obtained are utilized in the United States, but small quantities are exported to Canada and Europe. The increasing demand for shells has resulted in the extension of the fishery into streams far remote from button factories.

The following statistics for the region indicated were originally issued as a special bulletin that was extensively distributed. Over 4,800 persons were engaged in taking the mussels and preparing them for market; and their boats, apparatus of capture, and accessory property was valued at $241,000. The shells were obtained principally with the appliance known as the crowfoot bar, which is peculiar to this fishery. The output was nearly 20,000 tons, for which the fishermen received $294,600. The pearls found in the mussels, which were for the most part only an incidental item, were valued at $149,000.

FRESH-WATER MUSSEL FISHERY OF STREAMS TRIBUTARY TO THE GULF OF MEXICO FROM THE OHIO RIVER SOUTHWARD IN 1912.

Items.	Big Sunflower River.		Black River and minor tributaries.		Caddo Lake.		Clinch River.		Cumberland River.		Duck River.		Green River.		Holston River.	
	No.	*Value.*	*No.*	*Value.*	*No.*	*Value.*	*No.*	*Value.*	*No.*	*Value.*	*No.*	*Value.*	*No.*	*Value.*	*No.*	*Value.*
Persons engaged:																
Fishermen	24		680		200		60		150		25		12		25	
Transporters			11						7							
Shoresmen			4				2		29				2			
Total	24		695		200		62		186		25		14		25	
Fishermen, classified by methods used:																
Crowfoot bars	15		55						115				12		15	
Tongs	22		*a* 485													
Forks			9													
Rakes			21													
Dredges			20													
Waders			202		*b* 200		60		35		25				10	
Total, exclusive of duplication	24		680		200		60		150		25		12		25	
Boats and vessels:																
Rowboats and barges	24	$120	625	$3,245	100	$250	60	$200	115	$902			12	$60	25	$75
Gasoline boats	1	100	41	5,410					19	3,425						
House boats			122	10,305					2	100						
Vessels transporting			3	2,140					2	4,700						
Total	25	220	791	21,100	100	250	60	200	138	9,127			12	60	25	75
Apparatus:																
Crowfoot bars ... pairs	15	75	55	504					109	1,243			12	170	15	105
Tongs	22	110	481	2,894												
Forks			9	9												
Rakes			21	58												
Dredges			10	500												
Total		185		3,965						1,243				170		105
Shore and accessory property		10		2,042		65		15		866		$25		15		15
Total investment		415		27,107		315		215		11,236		25		245		195

PRODUCTS.																
Shells:																
With crowfoot bars....tons..	40	400	104	1,977					1,267	14,862			100	1,400	98	1,568
With tongs....tons..	120	1,200	1,138	19,100												
With forks....tons..			15	201												
With rakes....tons..			24	379												
With dredges....tons..			53	1,072												
With hands....tons..			62	1,267			50	590								
Total	160	1,600	1,396	23,996			50	590	1,267	14,862			100	1,400	98	1,568
Pearls		112		44,730		20,000		1,200		7,274		5,200		250		1,000
Total value of products		1,712		68,726		20,000		1,790		22,136		5,200		1,650		2,568

Items.	Little River (branch of Red River).		Little River (branch of St. Francis River).		Muskingum River.		Neosho River.		Ohio River and minor tributaries.		Ouachita and Little Missouri Rivers.		Pearl River.		Saline River.	
	No.	*Value.*	*No.*	*Value.*	*No.*	*Value.*	*No.*	*Value.*	*No.*	*Value.*	*No.*	*Value.*	*No.*	*Value.*	*No.*	*Value.*
Persons engaged:																
Fishermen	2		37		75		52		1,231		38		16		2	
Transporters									27				2			
Shoresmen									20		4		2			
Total	2		37		75		52		1,278		42		20		2	
Fishermen, classified by method used:																
Crowfoot bars			21		75				1,215		7					
Tongs			37						23		23		16			
Forks	2						50		39		29		7			
Dredges							6									
Waders							2		2						2	
Total, exclusive of duplication	2		37		75		52		1,231		38		16		2	
Boats and vessels:																
Rowboats and barges	2	15	37	185	78	598	53	315	1,240	6,819	38	179	7	90	2	10
Gasoline boats			1	75	11	1,465			131	20,370			2	1,050		
House boats					4	450			172	15,535	1	150				
Vessels transporting									13	28,775						
Total	2	15	38	260	93	2,513	53	315	1,556	71,499	39	329	19	1,140	2	10

[a] Includes 5 women.

[b] Includes 35 women

FRESH-WATER MUSSEL FISHERY OF STREAMS TRIBUTARY TO THE GULF OF MEXICO FROM THE OHIO RIVER SOUTHWARD IN 1912—Contd.

Items.	Little River (branch of Red River).		Little River (branch of St. Francis River).		Muskingum River.		Neosho River.		Ohio River and minor tributaries.		Ouachita and Little Missouri Rivers.		Pearl River.		Saline River.	
	No.	*Value.*	*No.*	*Value.*	*No.*	*Value.*	*No.*	*Value.*	*No.*	*Value.*	*No.*	*Value.*	*No.*	*Value.*	*No.*	*Value.*
Apparatus:																
Crowfoot bars.....pairs..			721	$318	75	$1,005			1,214	$14,936	7	$60				
Tongs			3	202					23	105	30	200	16	$135		
Forks	2	$2					50	$75	39	46	29	43	7	8		
Dredges							1	500								
Total		2		520		1,005		575		15,087		303		143		
Shore and accessory property		5		75		250		305		3,064		49		30		$20
Total investment		22		855		3,768		1,195		89,650		681		1,313		30
PRODUCTS.																
Shells:																
With crowfoot bars.....tons..			67	545	608	12,160			8,218	105,112	18	390				
With tongs.....tons..			189	1,845					29	528	69	1,217	192	1,860		
With forks.....tons..	10	150					900	9,000	99	1,886	100	1,428	20	200		
With dredges.....tons..							100	1,000								
With hands.....tons..	5	75					9	63	2	16					67	988
Total	15	225	256	2,390	608	12,160	1,009	10,063	8,348	107,542	187	3,035	212	2,060	67	988
Pearls		25		125		2,115		2,000		11,349		270		200		30
Total value of products		250		2,515		14,275		12,063		118,891		3,305		2,260		1,018

Items.	St. Francis River.		Tennessee River.		Tombigbee River.		Tuscarawas River.		White River and minor tributaries.		Total.	
	No.	*Value.*	*No.*	*Value.*	*No.*	*Value.*	*No.*	*Value.*	*No.*	*Value.*	*No.*	*Value.*
Persons engaged:												
Fishermen	290		152		8		a 3		1,583		4,665	
Transporters			2						42		91	
Shoresmen	20		12		2				13		110	
Total	310		166		10		3		1,638		b 4,866	
Fishermen, classified by methods used:												
Crowfoot bars	149		152		8		3		c 951		2,793	
Tongs	282				8				336		1,232	
Forks	5								223		364	
Rakes											21	
Dredges									17		43	
Waders									513		1,051	
Total, exclusive of duplication	290		152		8		3		1,583		4,665	
Boats and vessels:												
Rowboats and barges	314	$1,632	154	$2,830	10	$465	3	$15	1,367	$8,626	4,276	$26,631
Gasoline boats	38	4,735	9	2,515					193	20,400	446	59,545
House boats	50	3,540							228	16,910	579	46,990
Vessels transporting			1	3,500					6	17,150	25	56,265
Total	402	9,907	164	8,845	10	465	a 3	15	1,794	63,086	5,326	189,431
Apparatus:												
Crowfoot bars ... pairs	159	1,618	152	1,187	8	65	a 3	66	950	10,544	2,795	31,896
Tongs	292	1,752			8	36			336	1,887	1,245	7,321
Forks	5	6							223	238	364	427
Rakes											21	58
Dredges									8	500	19	1,500
Total		3,376		1,187		101		66		13,169		41,202
Shore and accessory property		883		246		5		5		2,863		10,853
Total investment		14,166		10,278		571		86		79,118		241,486

a Exclusive of 4 men with boats and crowfoot bars shown under Muskingum River.
b Includes 56 women.
c Includes 3 women.

Fresh-Water Mussel Fishery of Streams Tributary to the Gulf of Mexico from the Ohio River Southward in 1912—Cont'd.

Items.	St. Francis River.		Tennessee River.		Tombigbee River.		Tuscarawas River.		White River and minor tributaries.		Total.	
PRODUCTS.												
Shells:	*No.*	*Value.*	*No.*	*Value.*	*No.*	*Value.*	*No.*	*Value.*	*No.*	*Value.*	*No*	*Value.*
With crowfoot bars .... tons..	291	$5,719	908	$10,149	15	$150	60	$960	2,737	$55,129	14,531	$210,521
With tongs .... tons..	904	18,652	....	....	40	400	....	....	520	10,766	3,201	55,568
With forks .... tons..	15	300	....	....	....	....	....	....	118	2,118	1,277	15,283
With rakes .... tons..	....	....	....	....	....	....	....	....	....	....	24	379
With dredges .... tons..	....	....	....	....	....	....	....	....	150	3,019	303	5,091
With hands .... tons..	....	....	....	....	....	....	....	....	184	4,765	379	7,764
Total	1,210	24,671	908	10,149	55	550	60	960	3,709	75,797	19,715	294,606
Pearls	....	5,098	....	912	....	80	....	200	....	46,951	....	149,121
Total value of products	....	29,769	....	11,061	....	630	....	1,160	....	122,748	....	443,727

Fresh-Water Pearl Button Industry of the United States in 1912.

Items.	Alabama and Kentucky.		Kansas, Arkansas, and Oklahoma.		Illinois.		Indiana.		Iowa.		Maryland and Pennsylvania.		Michigan and Minnesota.	
Persons engaged:	*Male.*	*Female.*	*Male.*	*Female.*	*Male.*	*Female.*	*Male.*	*Female.*	*Male.*	*Female.*	*Male.*	*Female.*	*Male.*	*Female.*
Proprietors	10		8		93		25		115		3		14	
Managers	3		5		6		3		30		2		3	
Clerks and agents		1	3	6	1	2	1	1	75	23	2	2	1	1
Other employees	117		352	2	563	60	271	55	2,227	1,179	135	79	157	
Total	130	1	368	8	663	62	300	56	2,447	1,202	142	81	175	1
Wages paid	$38,413		$148,747		$257,551		$120,149		$1,766,933		$37,300		$44,499	
Classification of plants:	*No.*	*Value.*	*No.*	*Value.*	*No.*	*Value.*	*No.*	*Value.*	*No.*	*Value.*	*No.*	*Value.*	*No.*	*Value.*
Complete button manufacture							1		9		1		1	
Cutting only	4		7		36		11		60				6	
Finishing and grading only									3		2			
Grading only					1				1					
Crushers connected with factories	1		2		3		2		14				2	
Independent crushers							1		1					
Novelty works									3					
Total separate plants	4		7		37		13		76		3		7	
Property:														
Buildings and grounds		$7,900		$16,000		$290,602		$21,550		$398,621		$23,500		$24,910
Cutting machines	132	2,337	404	6,995	605	9,579	298	3,875	2,141	42,330	52	780	147	2,947
Automatic button machines—single									11	3,047	53	10,600		
Automatic button machines—double							10	10,000	339	462,142	15	10,000	10	20,000
All other machinery and equipment		3,200		8,025		55,237		7,865		198,847		8,300		4,400
Total investment		13,437		31,020		355,418		43,290		1,104,987		53,180		52,257
Shell products received:														
Shells ... tons	1,322	18,600	4,758	105,490	7,921	131,540	3,793	55,136	27,346	565,408	753	14,034	1,528	27,266
Blanks (purchased or from branch plants) ... gross			10,000	3,000	4,169	616	60,000	8,550	7,291,210	937,743	823,177	113,760	36,197	4,617
Waste shell ... tons							660	990	13,753	9,808			25	19
Total		18,600		108,490		132,156		64,676		1,512,959		127,794		31,902
Shell products consumed:														
Shells ... tons	985		3,967		8,079		4,330		26,298		303		1,062	
Blanks ... gross			10,000				60,000		5,591,625		708,077		36,197	
Waste shell ... tons	200				801		1,945		18,459				685	

FRESH-WATER PEARL BUTTON INDUSTRY OF THE UNITED STATES IN 1912—Continued.

Items.	Alabama and Kentucky.		Kansas, Arkansas, and Oklahoma.		Illinois.		Indiana.		Iowa..		Maryland and Pennsylvania.		Michigan and Minnesota.	
	No.	*Value.*	*No.*	*Value.*	*No.*	*Value.*	*No.*	*Value.*	*No*	*Value.*	*No.*	*Value.*	*No.*	*Value.*
Shell products manufactured:														
Buttons [a] .... gross..									12,226,471		237,283			
Blanks [b] .... do....	454,627		1,766,150		3,080,507		1,092,761		6,747,784		411,432		268,273	
By-products—														
Crushed shell .... tons..	200		820		647		1,380		15,092				636	
Dust .... do....					6		400		638					
Novelties										$43,141				
Shell products marketed:														
Buttons [a] .... gross..									12,646,920	2,846,691	237,283	$86,547		
Blanks [c] .... do....	454,627	$67,451	1,690,775	$267,495	3,101,968	$472,937	1,092,761	$150,089	6,171,571	1,065,619	411,432	57,600	266,273	$35,068
Shells for export .... tons..			52	3,483			13	643	69	4,028	25	1,274		
By-products:														
Crushed shell .... do....	200	800	880	4,920	597	1,825	1,460	7,020	14,844	75,408			187	1,569
Waste shell not crushed, tons	1,040	1,040	1,485	1,485	2,196	1,007	1,610	1,503	3,247	1,846	214	214		
Dust .... tons..					6	8	105	50	888	2,903				
Novelties										43,141				
Total		69,294		277,383		475,777		159,305		4,039,636		145,635		36,637
Freight charges paid on buttons, blanks, and shells		1,000		1,935		2,110		1,572		81,773		5,378		2,169

[a] The output of buttons for Indiana and Michigan is included with that of Wisconsin, as there is only one complete button factory in each of these three States; the buttons manufactured in Maryland are included with those of New York, where they are polished and graded; and the buttons for Missouri are included with those of Iowa.

[b] Includes all blanks except those made at factories where both the blanks and complete buttons are manufactured.

[c] Includes blanks cut at branch plants and made into buttons at the button factories.

Items.	Missouri.		New Jersey.		New York and Massachusetts.		Ohio and West Virginia.		Tennessee.		Wisconsin.		Total.	
Persons engaged:	*Male.*	*Female.*	*Male.*	*Female.*	*Male.*	*Female.*	*Male.*	*Female.*	*Male.*	*Female.*	*Male.*	*Female.*	*Male.*	*Female.*
Proprietors	21	....	15	2	25	....	....	....	3	....	26	....	358	2
Managers	5	....	1	....	7	....	4	....	1	....	2	....	72	....
Clerks and agents	12	4	2	3	61	31	....	2	....	....	10	2	168	78
Other employees	269	105	165	20	410	822	220	....	65	....	206	219	5,157	2,541
Total	307	109	183	25	503	853	224	2	69	....	244	221	5,755	2,621
Wages paid	$129,641		$55,816		$538,324		$101,758		$18,020		$126,537		$3,383,688	
Classification of plants:	*No.*	*Value.*	*No.*	*Value.*	*No.*	*Value.*	*No.*	*Value.*	*No.*	*Value.*	*No.*	*Value.*	*No.*	*Value.*
Complete button manufacture	2	....	3	....	3	....	....	....	....	....	1	....	21	....
Cutting only	8	....	....	....	....	....	4	....	3	....	14	....	153	....
Finishing and grading only	....	....	2	....	8	....	....	....	....	....	....	....	15	....
Grading only	....	....	....	....	....	....	....	....	....	....	....	....	2	....
Crushers connected with factories	2	....	....	....	....	....	2	....	....	....	4	....	32	....
Independent crushers	....	....	....	....	....	....	....	....	....	....	....	....	2	....
Novelty works	....	....	1	....	2	....	....	....	....	....	....	....	6	....
Total separate plants	10	....	5	....	12	....	4	....	3	....	15	....	196	....
Property:														
Buildings and grounds	....	$39,545	....	$91,000	....	$531,629	....	$14,900	....	$11,700	....	$52,619	....	$1,527,476
Cutting machines	303	4,805	65	2,000	116	2,400	250	3,090	61	1,163	182	2,720	4,756	85,021
Automatic button machines, single	....	....	....	....	52	22,000	....	....	....	....	....	....	116	35,647
Automatic button machines, double	31	31,000	15	21,250	329	353,861	....	....	....	....	25	37,000	774	948,853
All other machinery and equipment	....	15,034	....	9,450	....	176,674	....	2,550	....	1,327	....	22,275	....	513,184
Total investment	....	93,384	....	126,700	....	1,086,564	....	20,540	....	14,190	....	115,214	....	3,110,181
Shell products received:														
Shells ..... tons	3,776	71,948	460	13,810	167	5,409	3,423	50,017	706	10,378	2,182	38,706	58,135	1,107,742
Blanks (purchased or from branch plants) ..... gross	200,107	26,683	127,000	27,563	9,396,530	1,214,897	....	....	....	....	310,000	47,600	18,288,399	2,385,029
Waste shell ..... tons	1,030	773	....	....	....	....	....	....	....	....	110	62	15,578	11,652
Total	....	99,401	....	41,373	....	1,220,306	....	50,017	....	10,378	....	86,368	....	3,504,423
Shell products consumed:														
Shells ..... tons	2,921	....	276	....	329	....	4,009	....	686	....	2,426	....	55,671	....
Blanks ..... gross	200,107	....	401,200	....	10,033,592	....	....	....	....	....	310,160	....	17,380,958	....
Waste shell ..... tons	1,210	....	....	....	....	....	966	....	....	....	1,900	....	26,166	....

FRESH-WATER PEARL BUTTON INDUSTRY OF THE UNITED STATES IN 1912—Continued.

Items.	Missouri.		New Jersey.		New York and Massachusetts.		Ohio and West Virginia.		Tennessee.		Wisconsin.		Total.	
	No.	*Value.*	*No.*	*Value.*	*No.*	*Value.*	*No.*	*Value.*	*No.*	*Value.*	*No.*	*Value.*	*No.*	*Value.*
Shell products manufactured:														
Buttons [a] gross			541,400		11,223,853						1,677,876		25,906,883	
Blanks [b] do	772,149				21,871		1,125,651		216,501		577,133		16,534,842	
By-products—														
Crushed shell tons	1,700						649				1,975		23,099	
Dust do							70						1,114	
Novelties				$200		$18,500								$61,841
Shell products marketed:														
Buttons [a] gross			478,767	198,455	11,276,287	2,678,459					1,540,012	$363,334	26,179,069	6,173,486
Blanks [c] do	757,149	$108,999			20,942	1,257	1,125,651	$171,378	216,504	$35,323	575,454	77,998	15,885,107	2,511,217
Shells for export tons	10	608									3	125	172	10,161
By-products:														
Crushed shell do	1,700	8,550					649	3,090			2,013	11,540	22,530	114,722
Waste shell not crushed tons	259	128							250	310	235	42	10,536	7,575
Dust tons							70	70			150	438	1,219	3,469
Novelties				200		18,500								61,841
Total		118,285		198,655		2,698,216		174,538		35,633		453,477		8,882,471
Freight charges paid on buttons, blanks, and shells		4,236		6,604		41,372						4,010		152,159

NOTE.—Ocean shells were handled by seven firms, but the products of these are not included in the statistics.

[a] The output of buttons for Indiana and Michigan is included with that of Wisconsin, as there is only one complete button factory in each of these three States; the buttons manufactured in Maryland are included with those of New York, where they are polished and graded; and the buttons for Missouri are included with those of Iowa.

[b] Includes all blanks except those made at factories where both the blanks and complete buttons are manufactured.

[c] Includes blanks cut at branch plants and made into buttons at the button factories.

FRESH-WATER PEARL-BUTTON INDUSTRY.

A statistical canvass of this business was conducted in connection with the fresh-water mussel fishery, and detailed figures for all plants in the United States were obtained for the calendar year 1912. This industry has had an interesting history, and is now being actively aided by the artificial propagation of mussels and by special investigations of mussel resources of various streams. The manufacture of pearl buttons from the shells of fresh-water mussels began in the United States in 1891. The first factory was at Muscatine, Iowa, which soon became and still is an important center of the business. Plants were early established in Illinois, Wisconsin, and other States of the Mississippi Valley; and in 1912 the industry, in some of its branches, was conducted in 20 States.

The results of this canvass, as shown in the table on pages 31 to 34, have already been given to the trade through the medium of a special bulletin. It appears that about 8,400 persons were employed and that over $3,380,000 were paid in wages. The capital invested in the industry was $3,110,000, and the output of buttons, blanks, shells for export, and other products was valued at $8,882,000.

TUNA INDUSTRY OF CALIFORNIA.

The California tuna fishery and the canning industry connected therewith have been the subject of a special inquiry. The recent growth of this branch of the fisheries has been marked, and still greater development may be expected locally and elsewhere as a result of the success attained.

There are three fish known locally as "tuna" in California, but only one species, the long-finned tuna or albacore (*Germo alalunga*), is used for canning purposes. The long-finned tuna occurs plentifully in the waters of southern California and can be taken with so little effort that it was formerly brought into port in considerable numbers, although no local market existed at the time. Experimental canning was begun about five years ago by a sardine-packing concern located in San Pedro. The first attempts to can this fish were unsatisfactory, and it soon became apparent that some radical departure from the ordinary fish-canning methods would be necessary. The essential feature of the method finally adopted is to bake the fish before it is put in the can and to introduce a vegetable oil to bring out the latent merits of the tuna. Other plants soon sprang up at San Pedro and San Diego, and the pack leaped from 250 cases the first year to 115,000 cases in 1913, in which year there were 9 plants in operation. The indications are that in 1914 the output may reach 400,000 cases.

The long-finned tuna is comparatively short and exceptionally thick bodied. Although single specimens weighing 100 pounds have been taken, the average weight is about 30 pounds. It makes its appearance in the waters of southern California early in the spring, and the fishery is often carried on as late as December. The fishermen report that these fish often disappear for months between June and November, and the theory has been advanced that they may spawn during this period. The long-fin is a high-sea fish, rarely taken near shore, and moves in large well-distributed schools at a depth of about 10 feet. Often when the long-fin can be seen in plentiful quantities by the fishermen it is impossible to secure a catch owing to the presence in the schools of leaping and yellow-finned tunas. These gamey, swift-moving fish, owing to their prowess, are able to reach the bait before their less active associates.

Some fishermen entertain the belief that the best fishing grounds for the long-fin are at considerable distances from shore and that larger catches could be made with larger vessels on longer trips. The proper equipment has never been provided, however, and the fishermen have not yet tested this theory with their present craft. The boats employed are small, open motors driven by engines averaging about 8 horsepower. Usually three or four men constitute a crew, although some boats operate with only two.

Hand lines are used exclusively in securing the commercial catch, which until recently was taken by trolling. The Japanese are credited with introducing the method of "chumming" now in vogue and being employed with success. Before starting on a trip the fishermen prepare a quantity of bait for chumming by chopping up sardines and other small fish common in the local waters. When the fishermen are on the way to the fishing grounds they catch sardines for bait by seining alongside the boat; the sardines are placed in a tank on board, and the water is renewed frequently to keep the bait in good condition. To test the ground, a live sardine is placed on a trolling line and the boat proceeds slowly. When a strike is made, indicating the presence of a school, the engine is stopped and the chopped bait is thrown overboard to keep the school about the boat. The hand lines are then baited with live sardines; and if the fish are running well they can be taken almost as fast as the lines can be cast and hauled. It is reported that two men have taken a ton of tuna by this method in less than an hour. Daily trips to the fishing grounds are made, and the fleet returns each afternoon or evening to the canneries, the fish being dressed on the homeward trip when this is practicable.

When landed at the cannery the fish are placed in hanging racks to drain the blood from them and insure the whiteness of the meat. After draining they are placed in trays in a large low-pressure retort, where they are baked in live steam. As the fish usually arrive at the plant in the late afternoon or evening, the night is generally devoted to this stage of the process. Next morning the baked fish are transferred from the retorts to the filling tables. Before the meat is put into the cans it is carefully carved, the bones, skin, and dark meat being removed. The white meat, kept as nearly whole as possible, then passes to the filling crew. In addition to a pinch of salt, a small quantity of oil is placed in each can prior to filling, to supply the lack of natural oil in the fish. Olive oil was originally used for this purpose, but in 1913 all the plants except one discontinued this practice and substituted cottonseed oil, which, it is claimed, has given equal satisfaction. The solderless process is employed almost exculsively in tuna canning, so that from the filling tables the cans proceed to the topper, thence through the exhaust box to retorts similar to those employed in salmon canneries, where the fish are again cooked in steam under pressure. This product is now being marketed both as "tuna" and "tunny."

A few of the canning companies have experimented in the packing of long-finned tuna in other forms. Kippered tuna is an exceptionally palatable product, and is said to find a ready local sale in the State.

UTILIZATION OF NEGLECTED AQUATIC RESOURCES.

For a number of years the Bureau has been conducting inquiries into the potential value and possibility of using certain aquatic products which are wholly neglected or but inadequately utilized in the United States. A notable case is the sea mussel, concerning which various reports had been issued; but aside from some little newspaper comment only slight public notice has been given to the recommendations and suggestions which have been made. In January, 1914, an advantageous opportunity was presented for introducing this cheap, abundant, and excellent mollusk in one of the prominent hotels of Boston, and by the judicious cultivation of newspaper publicity the experiment attracted so much attention that within a few months mussels were being served and given a conspicuous place on the menus of over 70 of the principal hotels, restaurants, and clubs of the city. After the public had become familiar with the new article of food, either by actual trial in the public dining rooms or through the numerous newspaper articles, both serious and humorous, arrangements were made to have them placed on sale by retail dealers and vendors, who were furnished with large placards giving the product the Bureau's indorsement. Simultaneously there was issued and generously distributed a circular explaining the nature of sea mussels, their excellence, abundance, and cheapness, and giving a number of tested recipes for cooking them. About the same time every police station in the city was supplied with mussels and circulars for the use of the officers in their homes, thus establishing foci of information concerning the new food in all parts of the city.

This practical campaign attracted wide attention and placed the mussel as a regular commodity in the markets of Boston and adjacent communities, to the benefit of consumer, dealer, and fisherman. The propaganda will be extended to other parts of the seaboard; and as the mussel is excellent as a canned product, prepared in a variety of ways, its consumption should be eventually extended to all parts of the country.

Preliminary experiments and inquiries have been made for a somewhat similar campaign to secure the utilization of the dogfish, but as this species is the victim of prejudice, and other impediments to its exploitation are recognized, it is probable that legislation giving the Bureau additional authority in the use of its appropriations and employees will be necessary. The dogfish, on account of its rapacity, is a scourge to the fisheries, and so long as it remains unutilized is not only itself wasted, but raises the price of recognized food fishes by interfering with their capture. The Bureau believes that it is impracticable to materially reduce the numbers of these destructive little sharks, but that if they can be brought into consumption as food there will accrue not only relief to the now harried fisherman but a double benefit to the consumer.

PROPAGATION AND DISTRIBUTION OF FOOD FISHES.

GENERAL EXTENT OF THE WORK.

The fish-cultural operations of the Bureau during the fiscal year 1914 were attended by a high degree of success, and the output exceeded that of any previous year. This was accomplished without increase in funds over those available in 1913. The work was for the most part conducted along established lines, with special attention to increased efficiency; and the noteworthy results attained have come chiefly through the development of present resources and the extension of the operations into territory contiguous to existing fields of activity.

The egg taking and hatching operations were conducted in 34 States and Alaska, and upward of 40 food and game fishes and the lobster were propagated. The output aggregated 4,047,643,417 fish and eggs. Of this number, 485,000,000 represented the migratory food fishes of the Atlantic coast streams, 1,020,000,000 the commercial fishes of the Great Lakes, 2,276,000,000 the food fishes of the north Atlantic coast, 223,000,000 the salmons of the Pacific seaboard, and the remainder the fishes of the minor interior waters. About 98 per cent of the output represents the commercial food fishes, and a very large percentage of these were hatched from eggs which, under natural conditions, would have been lost. The following table summarizes the distribution of fish and eggs for the year:

Summary of Distributions, 1914.

Species.	Eggs.	Fry.	Fingerlings, yearlings, and adults.	Total.
Catfishes			554,310	554,310
Carp			231,146	231,146
Sucker			1,200	1,200
Buffalofish		150,000	147,195	297,195
Shad		61,827,660		61,827,660
Alewife		184,000		184,000
Whitefish	126,580,000	327,435,000		454,015,000
Lake herring		900,000		900,000
Silver salmon	95,840	24,619,456	27,258	27,742,554
Chinook salmon	26,451,545	48,895,607	5,582,796	80,929,948
Blueback salmon	6,020,000	53,071,574	120,000	59,211,574
Humpback salmon		44,817,644	34,355	44,851,999
Dog salmon		8,672,735		8,672,735
Steelhead trout	579,000	4,022,438	313,620	4,915,058
Rainbow trout	1,091,950	181,890	1,656,229	2,930,069
Atlantic salmon		2,573,295	16,993	2,590,288
Landlocked salmon	276,000	329,736	356,332	962,068
Scotch sea trout			20,396	20,396
Blackspotted trout	3,381,240	967,530	2,442,100	6,790,870
Lock Leven trout			46,500	46,500
Lake trout	11,283,000	33,114,171	2,719,473	47,116,644
Brook trout	2,055,000	4,128,290	5,891,033	12,074,323
Smelt	9,400,000	5,775,000	9,400	15,184,400
Grayling	150,000	343,000		493,000
Crappies			549,920	549,920
Rock bass			78,045	78,045
Warmouth bass			1,085	1,085
Small-mouth black bass		91,000	96,745	187,745
Large-mouth black bass			822,650	822,650
Sunfishes			690,757	690,757
Pike and pickerel			5,675	5,675
Pike perch	331,950,000	185,914,000		517,864,000
Yellow perch	9,500,000	179,924,389	12,775	189,437,164
Striped bass		11,689,000		11,689,000
White perch	1,400,000	218,600,000	2,000	220,002,000
White bass			4,450	4,450
Mackerel		2,510,000		2,510,000
Cod		252,951,000		252,951,100
Pollock		561,408,422		561,408,422
Haddock		108,584,000		108,584,000
Flounder		1,171,321,000		1,171,321,000
Lobster		179,990,000	3,567	179,993,567
Total	530,213,575	3,494,991,837	22,438,005	4,047,643,417

Distributions of fishes suitable for stocking public waters or restocking depleted ones were made in practically every State in the Union and Alaska, while thousands of small streams, lakes, and ponds—the majority of them located on farms—were stocked with black basses, crappies, sunfishes, catfishes, and other desirable species. The distribution of this output necessitated 611,691 miles of railroad travel, 131,156 of which were performed by the Bureau's cars and the remainder (480,535 miles) by detached messengers. All transportation was paid for, with the exception of 96,463 miles.

While the artificial propagation of some valuable food fishes was on a smaller scale than usual, owing to the local climatic conditions prevailing during the spawning season and to other factors over which the Bureau had no control, large gains were made in other fields where natural conditions were more favorable. Among the species propagated in larger numbers than in the previous year were the chinook, silver, humpback, dog, and landlocked salmons, lake trout, pike perch, striped bass, sunfishes, smelt, cod, and flounder.

The popularity of the Bureau's work in stocking public and private waters, and the benefits accruing therefrom, are indicated by the widespread interest displayed by people living in all sections of the country. The applications for food and game fishes received during the year numbered more than 10,500, fully 75 per cent of them being for the black basses, crappies, sunfishes, and other pond fishes, for stocking natural interior waters of small area and artificially constructed ponds on farms.

Notwithstanding the annual growth and expansion of the Bureau's activities, its present facilities are heavily taxed in the attempt to fill the constantly growing demand from all sections of the country for fishes for public and private waters. Large as are the annual distributions, the output of none of the species exceeds the actual needs and in some instances falls short of the requirements. This is particularly true of the warm-water fishes adapted to cultivation in ponds. Owing to the impracticability of propagating such species by the artificial manipulation of the eggs, in accordance with the methods pursued in salmon and trout culture, the annual supplies are so limited that the Bureau has great difficulty with its present facilities in meeting the growing demands.

Notwithstanding the great development of fish hatching in the United States, the possibilities for effective work in various sections of the country remain practically unlimited; and with adequate financial support the Bureau can make vast unproductive areas in the South and West, in the Great Lakes and Rocky Mountain regions, on the Pacific coast, and in Alaska yield immense numbers of food and game fishes for stocking public waters.

HATCHERIES OPERATED.

Fish-cultural work in 1914 was carried on at 36 permanent hatcheries and 94 subhatcheries and egg-collecting stations, located in 34 States and Territories. Two new stations were added to the service by the partial completion of those at Louisville, Ky., and Orangeburg, S. C., where fish-cultural operations on a small scale were inaugurated late in the year.

Following is a list of the stations, with the subsidiary stations thereunder, the period of operation, and the species handled. The main stations, arranged alphabetically, are those for which a superintendent and permanent staff are provided by law. In some cases, however, the subsidiary or auxiliary stations are completely equipped, semi-independent, and quite as important as the head station to which, for administrative purposes, they are attached.

FISH-CULTURAL STATIONS OPERATED DURING THE FISCAL YEAR 1914.

Designation.	Period of operation.	Species handled.
Afognak, Alaska	Entire year	Blueback, humpback, and silver salmon.
Eagle Lake, Alaska	May 30-Oct. 7	Blueback salmon.
Uganak Lake, Alaska	June 11-Oct. 2	Do.
Baird, Cal	Entire year	Chinook salmon.
Battle Creek, Cal	Sept. 1-Apr. 30	Do.
Hornbrook, Cal	Sept. 1-May 14	Chinook and silver salmon and rainbow trout.
Mill Creek, Cal	Sept. 1-Jan. 31	Chinook salmon.
Baker Lake, Wash	Entire year	Blueback, humpback, and silver salmon.
Birdsview, Wash	do	Chinook, dog, and humpback salmon.
Darrington, Wash	Aug. 20-May 3	Silver salmon and steelhead trout.
Day Creek, Wash	Aug. 12-May 24	Silver salmon.
Duckabush, Wash	Entire year	Chinook, dog, humpback, and silver salmon and steelhead trout.
Illabott Creek, Wash	July 1-Mar. 16	Do.
Quilcene, Wash	Entire year	Dog, humpback, and silver salmon and steelhead trout.
Sultan, Wash	do	Chinook, dog, humpback, and silver salmon and steelhead trout.
Battery, Md	May 19-May 29	Shad, herring, white perch, and yellow perch.
Boothbay Harbor, Me	Entire year	Cod, haddock, pollock, flatfish, and lobster.
Portland, Me	July-September	Lobster.
Bozeman, Mont	Entire year	Brook, black-spotted, rainbow, steelhead, and lake trout; grayling; and landlocked salmon.
O'Dell Creek, Mont	Apr. 7-May 15	Grayling.
South Meadow Creek, Mont.	Mar. 9-May 6	Grayling and rainbow trout.
Yellowstone Park, Wyo	July 1-Aug. 27; May 30-June 30.	Black-spotted trout.
Clear Creek, Wyo	July 1-July 23; June 15-June 30.	Do.
Columbine Creek, Wyo	July 1-July 19; June 18-June 30.	Do.
Cub Creek, Wyo	July 1-July 23; June 16-June 30.	Do.
Lake Camp, Wyo	July 1-Aug. 27; May 30-June 30.	Do.
Pelican Creek, Wyo	June 10-June 30	Do.
Thumb Camp, Wyo	June 1-June 21	Do.
Bryans Point, Md	Feb. 12-May 28	Shad and yellow perch.
Cape Vincent, N. Y	Entire year	Whitefish; lake herring; lake, brook, and rainbow trout; landlocked salmon; pike perch; and smallmouth black bass.
Three Mile Bay, N. Y	Nov. 15-Nov. 30	Lake herring.
Central Station, Washington, D. C.	Entire year	Large and small mouth black bass; warmouth and rock bass; crappie; catfish; sunfish; pike perch; shad; whitefish; white and yellow perch; smelt; brook and rainbow trout; and humpback salmon.
Clackamas, Oreg	do	Chinook and silver salmon; and blacks-potted, steelhead, brook, and rainbow trout.
Applegate Creek, Oreg	Sept. 10-May 31	Silver salmon and steelhead trout.
Big White Salmon, Oreg	Aug. 1-Feb. 29	Chinook salmon.
Eagle and Tanner Creeks, Bonneville, Oreg.	Sept. 1-Oct. 31	Do.
Eagle Creek, Barton, Oreg	Apr. 1-June 20	Steelhead trout.
Illinois River, Oreg	Sept. 1-Jan. 1	Chinook and silver salmon.
Little White Salmon, Wash.	Entire year	Chinook salmon.
Lower Rogue River, Oreg	Aug. 15-Mar. 31	Do.
Rogue River, Oreg	Entire year	Chinook and silver salmon and steelhead and black-spotted trout.
Upper Clackamas, Oreg	do	Chinook and silver salmon and steelhead trout.
Willamette Falls, Oreg	June 15-June 30	Shad.
Cold Springs, Ga	Entire year	Large-mouth black bass, catfish, and sunfish.
Harris Pond, Ga	do	Catfish and sunfish.

FISH-CULTURAL STATIONS OPERATED DURING THE FISCAL YEAR 1914—Continued.

Designation.	Period of operation.	Species handled.
Craig Brook, Me	Entire year	Atlantic, landlocked, and humpback salmon; brook, rainbow, and Scotch Sea trout; and hybrids.
Upper Penobscot, Me	Jan. 1–June 1	Atlantic salmon.
Duluth, Minn	Entire year	Lake trout; whitefish, pike perch; brook, rainbow, and steelhead trout, and landlocked salmon.
Grand Marais, Minn	Oct. 10–Dec. 2	Lake trout.
Isle Royale, Mich	Sept. 21–Nov. 12	Lake trout and whitefish.
Keweenaw Point, Mich	Oct. 5–Nov. 2	Lake trout.
Marquette, Mich	Oct. 13–Nov. 12	Do.
Munising, Mich	do	Do.
Ontonagon, Mich	Oct. 22–Nov. 13	Do.
Edenton, N. C	Entire year	Shad, bream, and black bass.
Weldon, N. C	Apr. 1–May 30	Striped bass.
Erwin, Tenn	Entire year	Rainbow and brook trout, large and small mouth black bass, rock bass, sunfish, yellow suckers, and carp.
Gloucester, Mass	do	Pollock, cod, flatfish, haddock, and lobster.
Boston, Mass	Nov. 1–Dec. 13	Lobster.
Rockport, Mass	May 1–July 15	Do.
Green Lake, Me	Entire year	Landlocked and humpback salmon, brook and lake trout, and smelt.
Grand Lake Stream, Me	do	Landlocked salmon.
Homer, Minn	do	Large and small mouth black bass, pike and yellow perch, rock bass, crappie, sunfish, buffalo fish, catfish, and carp.
La Crosse, Wis	Aug. 21–Oct. 24	Buffalo fish, catfish, yellow perch, large and small mouth black bass, crappie, sunfish, and rock bass.
Leadville, Colo	Entire year	Rainbow, brook, and black spotted trout.
Antero Reservoir, Colo	May 7–May 16	Rainbow trout.
Cheesman Lake, Colo	Apr. 7–May 15	Do.
Edith Lake, Colo	Oct. 15–Nov. 15	Brook trout.
Eldora Lake, Colo	do	Do.
Engelbrechts Lake, Colo	Oct. 9–Nov. 14	Do.
Musgrove Lakes, Colo	Oct. 16–Dec. 1	Do.
Seven Lakes, Colo	July 1–July 11; June 9–June 30	Black-spotted and rainbow trout.
Smiths Ponds, Colo	Oct. 25–Nov. 28	Brook trout.
Scotts Ponds, Colo	Oct. 5–Oct. 21	Do.
Turquoise Lake, Colo	Oct. 14–Nov. 22	Do.
Uneva Lake, Colo	Oct. 27–Nov. 12	Do.
Wellington Lake, Colo	Oct. 16–Nov. 25	Do.
Louisville, Ky	April–June	Large-mouth black bass.
Mammoth Spring, Ark	Entire year	Large and small mouth black bass, crappie, sunfish, catfish, and carp.
Friars Point, Miss	July and August	Black bass, catfish, and sunfish.
Manchester, Iowa	Entire year	Brook, rainbow, and lake trout; large and small mouth black bass; rock bass; crappie; bream; pike perch; pike; yellow perch, white bass; buffalo fish, catfish, and carp.
Bellevue, Iowa	July 1–Nov. 15	Large-mouth black bass, crappie, bream, catfish, white bass, carp, yellow perch and buffalofish.
North McGregor, Iowa	July 1–Oct. 4	Large-mouth black bass, yellow perch, crappie, catfish, pike, carp, and buffalofish.
Nashua, N. H	Entire year	Brook and rainbow trout, landlocked salmon, and small-mouth black bass.
Neosho, Mo	do	Rainbow trout, black bass, small-mouth black bass, crappie, strawberry bass, sunfish, carp, catfish, yellow perch, and pike perch.
Northville, Mich	do	Lake, brook, and rainbow trout; grayling; small-mouth black bass; and sunfish.
Au Gres, Mich	Nov. 16–Nov. 30	Whitefish.
Au Sable, Mich	Nov. 10–Nov. 25	Lake trout.
Bay City, Mich	Apr. 11–Apr. 28	Pike perch.
Belle Isle, Mich	Oct. 24–Dec. 16	Whitefish.
Charity Island, Mich	Oct. 6–Nov. 15	Do.
Charlevoix, Mich	Oct. 27–Nov. 30; Feb. 24–Apr. 25	Lake trout.
Detour, Mich	Oct. 20–Nov. 14	Do.
Detroit, Mich	Entire year	Whitefish and pike perch.
Fairport, Mich	Oct. 30–Nov. 21	Lake trout.
Frankfort, Mich	Nov. 3–Nov. 25	Do.
Grassy Island, Mich	Oct. 13–Dec. 3	Whitefish.

FISH-CULTURAL STATIONS OPERATED DURING THE FISCAL YEAR 1914—Continued.

Designation.	Period of operation.	Species handled.
Northville, Mich.—Continued.		
Manistique, Mich	Oct. 30-Nov. 22; Nov. 28 Dec. 9.	Lake trout and whitefish.
Naubinway, Mich	Nov. 22-Nov. 27	Whitefish.
St. James, Mich	Oct. 29-Dec. 16	Lake trout and whitefish.
St. Joseph, Mich	Oct. 30-Nov. 28	Lake trout.
Sault Ste. Marie, Mich	Feb. 15-May 15	Lake trout and whitefish.
Orangeburg, S. C	Apr.-June	Large-mouth black bass.
Put-in Bay, Ohio	Entire year	Whitefish, lake trout, and pike perch.
Kellys Island, Ohio	Nov. 11-Dec. 8	Whitefish.
Middle Bass, Ohio	Nov. 12-Nov. 30; Apr. 12-Apr. 30.	Whitefish and pike perch.
Monroe, Mich	Oct. 30-Dec. 1	Whitefish.
North Bass, Ohio	Nov. 6-Dec. 6; Apr. 12-Apr. 28.	Pike perch.
Port Clinton, Ohio	Nov. 3-Dec. 4; Apr. 3-May 2	Whitefish and pike perch.
Toledo, Ohio	Nov. 6-Dec. 4; Apr. 1-May 7	Do.
Quincy, Ill	Entire year	Office headquarters.
Meredosia, Ill	do	Large and small mouth black bass, catfish, yellow perch, rock bass, pike perch, buffalofish, yellow bass, white bass, sunfish, crappie, etc.
St. Johnsbury, Vt	do	Brook, lake, and steelhead trout; landlocked salmon; small-mouth black bass, and catfish.
Averill Lakes, Vt	Sept. 16 Jan. 9	Landlocked salmon.
Darling Pond, Vt	July 28-Nov. 28	Brook trout.
Holden, Vt	Entire year	Brook, lake, and steelhead trout, and landlocked salmon.
Lake Mitchell, Vt	Oct. 1-Dec. 19	Brook trout.
Swanton, Vt	Mar. 25-June 1	Pike perch and yellow perch.
San Marcos, Tex	Entire year	Large-mouth black bass, crappie, strawberry bass, warmouth bass, sunfish, and rock bass.
Spearfish, S. Dak	do	Brook, rainbow, Loch Leven, black-spotted, and steelhead trout.
Schmidt Lakes, S. Dak	Oct. 20-Dec. 20	Brook trout.
Sand Creek, S. Dak	Oct. 20-Jan. 15	Do.
Tupelo, Miss	Entire year	Large-mouth black bass, bream, crappie, rock bass, warmouth bass, catfish, and yellow perch.
White Sulphur Springs, W. Va.	do	Brook and rainbow trout, and small and large mouth black bass.
Woods Hole, Mass	do	Cod, flatfish, and mackerel.
Noank, Conn	Mar. 20-Apr. 4	Flatfish.
Waquoit, Mass	Jan. 26-Apr. 8	Do.
Wickford, R. I	Mar. 9-Apr. 15	Do.
Wytheville, Va	Entira year	Rainbow and brook trout, large and small mouth black bass, rock bass, bream, and pike perch.
Yes Bay, Alaska	do	Blueback salmon.
Ketchikan Creek, Alaska	September	Humpback salmon.

COOPERATION WITH THE STATES.

In continuation of its cooperative relations with the States in fish-cultural work, the Bureau furnished during the year large allotments of eggs, and limited numbers of fry, fingerling, and yearling fish to stock State hatcheries. The extent to which the various States were recipients of the distribution of food and game fishes and of fish eggs during the year 1914 is shown in the table following.

ALLOTMENTS OF FISH AND EGGS TO STATE FISH COMMISSIONS FOR THE FISCAL YEAR 1914.

State and species.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
California:			
Brook trout	100,000	...	...
Chinook salmon	25,323,645	...	...
Silver salmon	95,840	...	...
Colorado: Black-spotted trout	600,000	...	...
Idaho:			
Black-spotted trout	205,000	...	...
Rainbow trout	150,000	...	...
Indiana: Pike perch	7,500,000	...	...
Illinois: Pike perch	7,500,000	...	...
Maine:			
Brook trout	100,000	...	...
Lake trout	50,000	...	...
Landlocked salmon	100,000	...	...
Maryland: Rainbow trout	30,000	...	...
Massachusetts:			
Black bass	...	...	400
Chinook salmon	50,000	...	...
Pike perch	20,225,000	...	...
Yellow perch	8,000,000	...	...
Michigan:			
Grayling	50,000	...	...
Lake trout	3,008,000	...	...
Landlocked salmon	25,000	...	...
Pike perch	15,000,000	...	...
Smelt	5,000,000	...	...
Minnesota:			
Lake trout	...	...	...
Landlocked salmon	15,000	...	...
Steelhead trout	50,000	...	...
Missouri:			
Brook trout	50,000	...	...
Rainbow trout	50,000	...	...
Pike perch	10,000,000	...	...
Montana:			
Black bass	...	...	66
Black-spotted trout	636,210	...	...
Brook trout	200,000	...	...
Lake trout	...	...	18,900
Whitefish	2,000,000	...	...
Nebraska:			
Pike perch	2,000,000	...	...
Rainbow trout	100,000	...	...
Nevada:			
Brook trout	50,000	...	...
Rainbow trout	98,000	...	...
New Hampshire:			
Brook trout	75,000	...	...
Landlocked salmon	30,000	...	...
Rainbow trout	50,000	...	...
Steelhead trout	50,000	...	...
White perch	1,000,000	...	...
New Jersey:			
Crappie	...	...	210
Landlocked salmon	10,000	...	...
Pike perch	...	2,500,000	...
Sunfish	...	...	500
Yellow perch	...	6,500,000	...
New York:			
Lake trout	100,000	...	...
Steelhead trout	50,000	...	...
North Dakota:			
Pike perch	5,000,000	...	...
Rainbow trout	100,000	...	...
Steelhead trout	100,000	...	...
Ohio:			
Pike perch	261,625,000	...	...
Whitefish	83,320,000	...	...
Oregon:			
Black-spotted trout	200,000	...	...
Blueback salmon	2,000,000	...	...
Brook trout	250,000	...	...
Chinook salmon	1,000,000	...	...
Rainbow trout	200,000	...	...
Pennsylvania:			
Lake trout	100,000	...	...
Whitefish	36,000,000	...	...

ALLOTMENTS OF FISH AND EGGS TO STATE FISH COMMISSIONS FOR THE FISCAL YEAR 1914—Continued.

State and species.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Utah:			
Brook trout	175,000		
Lake trout	50,000		
Steelhead trout	50,000		
Vermont:			
Brook trout			7,600
Lake trout	50,000		
Landlocked salmon	20,000		
Spotted catfish			138
Steelhead trout	50,000		
Washington:			
Blueback salmon	50,000		
Brook trout	100,000		
Steelhead trout	29,000		
Wisconsin:			
Lake trout	7,500,000		
Whitefish	5,000,000		
Wyoming:			
Black-spotted trout	800,000		
Brook trout	250,000		
Rainbow trout	192,000		
Steelhead trout	50,000		
Total	514,237,725	9,000,000	27,814

In order to minimize the possibility of injury resulting from the introduction of nonindigenous fishes into State waters, the Bureau has adhered to its policy of deferring to the judgment of the proper State officials regarding all applications for fish not native to a given State, and has definitely decided to discontinue the planting of predaceous fishes, such as the black basses, crappies, sunfishes, perches, pikes, and allied species, in any of the lakes or streams of the Pacific coast which are inhabited by salmon or trout or connected with trout and salmon waters. This policy, which commends itself to all who have the welfare of the fisheries at heart, has received the formal approval of fishery authorities and the congressional delegations of those States. Acting in pursuance thereof, the Bureau will henceforth refuse to entertain applications for any of the fishes mentioned for stocking waters in the Pacific Coast States.

PROPAGATION OF THE PACIFIC SALMONS.

The most extensive fish-cultural work done by the Bureau is addressed to the Pacific salmons. In 1914 hatching operations were conducted at 14 points and egg-collecting at 14 other points. The general results attained were gratifying, and the output materially exceeded that of 1913.

With the exception of the Quiniault region, Washington, where investigations are in progress looking toward the inauguration of fish-cultural work in that field, most of the more important salmon streams in Washington and Oregon are covered by the Bureau's operations, and with increased facilities for handling the eggs and young, the installation of permanent traps and barriers to intercept the run of fish, and the improvement of the water supply, which are now being provided for at many of the stations, the output another year should be materially increased.

A condition which curtailed the run of salmon in streams on Afognak Island, Alaska, in 1912–13 was again in evidence in the season of 1913–14; that is, the volcanic ash covering the island as a result of the eruption of Mount Katmai on June 6, 1912, proved a material obstacle to fish-cultural operations. The ash was washed from the mountain sides into the rivers and creeks with every rain, forming effectual barriers at the mouths of some of the streams against the entrance of salmon from the sea. The spawning of the red salmon commenced late in July and continued to the middle of October, but the run of fish in Litnik Lake and tributaries was small, and comparatively few ripe fish were secured. The fry resulting from this work numbered 7,761,700.

It had been planned to collect redfish eggs at Malena Lake, but an investigation developed the fact that the mouth of the creek forming the outlet of the lake was so filled with ash that the fish could not enter. Commercial fishermen from Malena reported that salmon ascended the river from the straits, but being unable to reach their spawning grounds returned to the ocean. The appearance of an unusually large run of humpback salmon in the vicinity of the station in October and November permitted the collection of 13,900,000 eggs and, incidentally, a few silver-salmon eggs. The output of fry of all species for the year numbered 19,846,104, an appreciable increase over that of the previous year.

Investigations at Eagle Harbor and Uganik Lake, on Kodiak Island, in the spring and summer of 1913, developed the fact that there is not a sufficient run of salmon at either of these points to warrant the establishment of a field collecting station, taking into consideration their inaccessible location and great distance from Afognak. It is now being planned to conduct investigations at several points nearer the main station, in the belief that more productive and less expensive fields can be found.

In the vicinity of the Yes Bay, Alaska, hatchery the run of red salmon in the summer and fall of 1913 was smaller than usual, and the output of fry was correspondingly reduced. Continuous rains throughout the spawning season caused unusually high water in the streams tributary to Yes Bay, making it exceedingly difficult to capture spawning fish in the deep, swift waters on the spawning beds; but by close and persistent application 49,050,000 eggs were secured, and 94 per cent of these were hatched. Of the resulting fry, 18,656,000 were distributed after the absorption of the yolk sac, and the remainder were held and fed until they had reached a length of 1½ to 2 inches. Humpback-salmon eggs to the number of 5,280,000 were collected near Ketchikan during the fall and transferred to the Yes Bay station for development. Important improvements effected at this station during the year included the installation of an electric lighting plant and the construction of three salmon-rearing ponds, each 12 by 60 feet.

The year's operations at the Washington stations were very successful, the output of all species numbering 48,892,246 fish and eggs. The collection of blueback-salmon eggs was considerably curtailed by the escape early in the season of a large number of brood fish which were being held in Baker River to ripen, and the outcome of the work with dog salmon and steelhead trout was not as great as had been anticipated. These shortages, added to the loss of young salmon at the time of the destruction of the Baker Lake hatchery by fire, materially reduced the output, but the substantial gains in the propagation of the chinook, humpback, and silver salmons gave an aggregate output nearly 10,000,000 in excess of that of the previous year.

Violent rains, followed by heavy floods, in streams contiguous to the Quilcene and Duckabush stations, on Hoods Canal, wrecked the racks and traps and completely destroyed a barrier that had been constructed in the Duckabush River; but notwithstanding these adverse conditions the work of the stations resulted satisfactorily. The run of humpback salmon in Hoods Canal during the fall of 1913 was enormous. Schools of salmon many acres in extent were observed near the mouths of the various streams as they slowly made their way up the canal. A very large number of these fish made their appearance below the racks at the Duckabush station before preparations had been completed for the collection of eggs, and the major part of them passed on up the river.

There was a slight falling off in the collection of chinook-salmon eggs in some fields in the State of Oregon, but this was more than compensated for by the gains in other parts of the State. The conditions affecting the run of chinook salmon in the Columbia River were similar to those existing in 1913. An enormous run of fish—said to be one of the largest known - appeared in the river early in September, increasing rapidly as the season advanced. At the stations on the Big White Salmon and Little White Salmon Rivers the 44,229,000 eggs taken far exceeded the capacity of the hatcheries, making it necessary to transfer large consignments of eggs to other stations for development. The destruction of the racks on the Clackamas and Lower Rogue Rivers and the failure of the usual run of fish into the Illinois River curtailed the output of chinook salmon in those fields. The distribution of silver salmon from the Oregon stations was nearly three times that of the previous year, while there was an average yield of steelhead trout.

The work accomplished at the California stations was satisfactory. The output of chinook-salmon fry and fingerlings was nearly double that of last year and of silver salmon fully ten times as great. The majority of the eggs taken on the McCloud River were secured from the fall run of fish, the spring run being very light. At the Battle Creek and Mill Creek auxiliaries, where only the fall run is available, 33,060,310 chinook-salmon eggs were collected. Silver-salmon eggs to the number of 3,129,000 were collected in the Klamath River. An attempt to secure eggs from the commercial fishermen on the Sacramento River resulted in failure, because of the irregularity of their operations and the poor success attained in transferring the green eggs in wagon over the rough mountain roads to the hatcheries for development. Another year an attempt will be made to capture brood salmon at the point where Mill Creek enters the Sacramento River and hold them between racks in the creek for the ripening of their eggs. There was only one run of chinook salmon in the Klamath River in the vicinity of the field station at Hornbrook, and as fully 50 per cent of the fish composing it were undersized the collections of eggs were inconsiderable.

The superintendent of the California stations reports that the State authorities have taken steps to protect the young salmon liberated in the Sacramento River by the rigid enforcement of the law compelling the screening of intakes to irrigating ditches and the easements and overflows of the river, thus preventing the passage of young salmon and their destruction on the lowlands. He also reports that the State Fish Commission has greatly increased its facilities for rearing salmon fry, and has improved its methods of distribution. Under the changed conditions there seems to be no necessity for changing the location of the Bureau's stations in California, or departing from the cooperative policy of turning over to the State hatcheries for development the surplus salmon eggs taken at the Baird and auxiliary stations.

The Bureau is providing facilities which will enable it to rear each year a larger percentage of salmon to the fingerling size, in the expectation that eventually most of the output may be liberated as fingerlings or, in some cases, yearlings. This procedure entails a large increase in expense, and the funds available do not permit the immediate establishment of all the rearing ponds and other facilities necessary to accommodate the entire product. A very important item of expense is food, and a cheap and efficient salmon food is one of the great desiderata. Various experiments have been undertaken with a view of decreasing the cost of feeding, and it is possible that the solution of the problem will be found in the utilization of the parent fish, which have heretofore been mostly wasted. By salting, drying, or freezing the bodies of the spent fish, a large quantity of food will be made available during the entire period when it is desirable to retain the young salmon.

In 1914 the cost of rearing salmon to the fingerling stage varied from 24.8 cents to 86 cents per thousand, according to the particular station and the average size of the fish at the time of planting. The lowest cost secured was that of rearing chinook salmon at the California stations.

The creation during the year of a Pacific district embracing all the Bureau's salmon stations in California, Oregon, Washington, and Alaska and the placing of their operations under the general direction of a field superintendent have been productive of good results. Many minor routine matters pertaining to the Pacific salmon work heretofore attended to in the Washington office are now acted upon by the field superintendent. Various improvements and much economy have been effected by the periodical inspection of the stations, and the central office is in a better position than heretofore to act intelligently upon matters relating to the salmon work.

FISH PROPAGATION ON THE GREAT LAKES.

The fish-cultural work on the Great Lakes is conducted at four main stations and numerous auxiliaries, and is addressed to three great commercial fishes—the lake trout, the whitefish, and the pike perch. Incidentally, the cisco or lake herring and other local food fishes are handled as circumstances permit.

The collecting of lake-trout eggs for stocking the Michigan and Minnesota hatcheries of the Bureau was subjected to the provisions of the new law enacted by the Michigan Legislature in 1912, which became operative for the first time in the fall of 1913. Under the old law the prohibitive season for fishing in the Michigan waters of the

Great Lakes began November 1, corresponding closely with the opening of the lake-trout spawning season, while the new law prescribed a close season from October 10 to November 1. Some good effects of the provision of law relative to the saving of trout spawn by the commercial fishermen permitted to fish during the close period were clearly apparent in Lake Superior fields, where about half the eggs collected were secured before November 1. The benefits of the law were hardly discernible, however, in the work on Lakes Michigan and Huron, as all but 3,840,000 of the eggs taken in these waters were obtained during the time when fishing operations were not restricted.

On Lake Superior the collecting of lake-trout eggs extended from September 21 to December 3, and 18,590,000 eggs of good quality were obtained and transferred to the Duluth hatchery. The stock of this hatchery was later supplemented by the transfer of 3,684,000 eggs from one of the fields in Lake Michigan. The season's work with the lake trout at Duluth resulted in an output of 1,050,000 eyed eggs, which were shipped on assignment to various State fish commissions and stations of the Bureau, and 16,225,000 fry and fingerling fish. Owing to the late spring the hatching period was delayed somewhat beyond the usual time, but both fry and fingerling fish were of uniformly fine quality, and the distributions, which extended from March 23 to June 14, were accomplished without mishap. While favorable weather on Lake Superior during the egg-collecting period is partly responsible for the success of the work, it may also be attributed in no small measure to the enforcement of the recently enacted fishery legislation.

Incidental to the lake-trout work, 2,205,000 very fine whitefish eggs were collected in one of the Lake Superior fields and hatched at the Duluth station in connection with a consignment of 25,000,000 of the same species shipped from Put-in Bay, Ohio. The latter consignment appeared to be of poor quality when received, but the unusually favorable water temperatures to which it was subjected during incubation made possible a yield from the combined stock of 15,750,000 healthy, vigorous fry, which were liberated late in April at suitable points in Lake Superior. Additional work accomplished at this station with the commercial fishes consisted in the hatching of 20,000,000 pike-perch eggs derived from the Detroit hatchery, and the distribution of the fry to applicants in Minnesota and Wisconsin.

The weather conditions in the lake-trout fields operated from the Michigan stations were favorable for the collection of eggs, with the exception of a severe storm on November 9, at the height of the spawning season, which caused a practical suspension of the work for nearly a week and materially reduced the season's collections. Six field stations for the collection and care of eggs received from the commercial fishermen were opened on Lake Michigan and two on Lake Huron, the more important ones being placed under the supervision of regular employees of the Bureau, while trained temporary men were hired to take charge of the minor stations. With the view of insuring a good quality of eggs, experienced spawn takers were also placed on the large steam tugs operating in the most productive fields, in order to instruct the fishermen in taking the eggs. Fishermen operating gasoline boats took the spawn without such assistance. Of the 52,910,380 eggs resulting from the season's collections, 19,192,000 were used to fill applications from State fish commissions and for stocking the Great Lakes hatcheries of the Bureau in other States. The remaining stock sufficed to fill the Sault Ste. Marie and Charlevoix hatcheries, and the fry hatched therefrom were returned to the spawning grounds in the immediate vicinity.

While the lake-trout work was in progress arrangements were made for the penning of brood whitefish near the important fisheries in the Detroit River and at Charity Island, in Saginaw Bay. At the latter point 5,393 fish had been collected and were being held in pens to ripen when the great storm of November 9 swept down on the station, carrying away most of the crates and with them 4,329 fish, valued at $1,500. Some of the damaged crates were recovered later, but the few fish remaining in them were dead. As the storm had totally destroyed the pound nets in the bay, thus putting a stop to the operations of the fishermen, the Bureau's work came to an abrupt end, with very inconsiderable results to compensate for the time and money expended. In the Detroit River, where the effects of the storm were not so severe, 103,280,000 eggs of medium quality were secured. In an effort to partially make up for the shortage of eggs caused by the failure of the work at Charity Island, three collecting stations were opened in December in the vicinity of relatively small fisheries in upper Lake Michigan, and here approximately 25,000,000 eggs were obtained. The stock was further supplemented by transfer from the Lake Erie fields of 41,400,000 green eggs, for the purpose of relieving the congested condition of the Put-in Bay hatchery. The eggs were placed in the Detroit and Sault Ste. Marie hatcheries, and in the process of eyeing very heavy losses resulted. Eyed eggs to the number of 5,600,000 were utilized in filling applications, and 101,100,000 fry were returned to the waters of the Great Lakes.

The whitefish fisheries of the Detroit River have been undergoing a steady decline for years, resulting in corresponding decreases in egg collections at Grassy Island and Belle Isle in that river. A deep ship canal is now in course of construction which will cut through a portion of Grassy Island, completely destroying the fishing grounds now operated by the Bureau in that river. The majority of the whitefish eggs now taken in Michigan waters are derived from the field station on Charity Island, in Saginaw Bay, established in 1910, and from several points in upper Lake Michigan. All the eggs thus taken are first shipped to the Detroit hatchery, and after reaching the eyed stage part of them are transferred and hatched at the auxiliary stations in northern Michigan, the resulting fry being deposited on the spawning grounds in the vicinity. This method, entailing the expense of double transportation of eggs for partial development and in order to facilitate the distribution of the fry on the spawning grounds, is hardly justifiable, and should be abandoned as soon as practicable.

The Bureau is now paying an annual rental of $425 for the use of the land on which the Detroit hatchery is located. In view of the heavy expense involved in the use of the Detroit station, which belongs to the State but has not been operated by the State for many years, it does not appear advisable, in view of the existing condition of the fisheries in the Detroit River, to continue the hatching operations at Detroit. It is therefore proposed to take steps to locate a desirable site for an auxiliary hatching station in the Saginaw Bay district, and when a suitable location is found it is hoped that Congress will provide an adequate appropriation for the acquirement of the land and the construction of the station.

The spawning season of the pike perch in Michigan waters was between April 11 and 28. The total collections of eggs from fish turned over to the Bureau by the commercial fishermen operating in Saginaw Bay and at the mouth of the Pine River amounted to 167,850,000, of which 35,000,000 were shipped green to outside Federal and State hatcheries. Fifteen million eyed eggs were turned over to the Michigan State Fish Commission, to fulfill the terms of the lease of the Detroit hatchery, and 25,530,000 fry were hatched from the remainder and liberated on the spawning grounds.

When the windstorm which created such havoc in the upper lakes struck the west end of Lake Erie, whitefish had assembled on the spawning grounds in considerable numbers, but as the weather prior to that time had been too warm for the holding of fish in crates, no penning operations had been undertaken at the various field stations operated in connection with the Put-in Bay, Ohio, station. The wind blew so violently for three days that the water was driven from the west end of the lake to such an extent that it fell from 4 feet to 5 feet below the normal level. Fishing apparatus of all kinds was greatly damaged, and the waters became so roily that the fish deserted the spawning grounds, and in some places returned only in comparatively small numbers. The fisheries in the vicinity of Port Clinton and along the south shore of the reefs sustained the greatest damage. Along the west shore the nets were more or less protected, and the current from the Detroit River soon cleared the water in the vicinity of the fisheries at Monroe Piers, producing ideal spawning conditions. Here the fish congregated in immense numbers, permitting of a catch far in excess of any previous year's record. At the Bureau's field station at this point 15,694 impounded fish yielded 122,160,000 eggs. These, added to the eggs purchased direct from the fishermen, brought the season's collections in the Monroe Piers field to 306,360,000, and had there been facilities for handling them many more might have been secured. The aggregate collections from all of the Lake Erie fields amounted to 488,240,000, far more than could be handled in the Put-in Bay hatchery with the existing facilities. Shipments of green eggs to the number of 233,760,000 were forwarded direct from the fields of collection to various Federal and State hatcheries, and similar disposition was made of 12,160,000 after the eye-spots appeared. The remainder were developed at the Put-in Bay station, producing 163,200,000 healthy, vigorous fry, all of which were returned to the spawning grounds in the lake.

The Ohio State Fish Commission having arranged to cover all available territory in a search for lake-herring eggs, the Bureau made no attempt to take up that work. Moreover, in view of the enormous collections of whitefish eggs, there would have been no room for lake-herring eggs had any been secured.

Only fair results were attained in the pike-perch work on Lake Erie. No severe storms occurred in the course of the spawning season, which extended from April 7 to May 7, but a succession of gales in several of the fields prevented the installation of the fishermen's nets until the season was well advanced. Especially was this true at Port Clinton, ordinarily one of the most prolific sections.

The more favorable weather conditions prevailing in other portions of the lake resulted in large catches of fish, but a large percentage of them were unripe. The work at Port Clinton was not hampered by this difficulty, and the collections there were more than twice as large as in all the other fields combined. The aggregate take from all sources was 592,000,000. The output included 296,625,000 green eggs, 47,100,000 eyed eggs, and 69,600,000 fry, about half of which were utilized in filling applications from neighboring States. The remainder were returned to the spawning grounds in Lake Erie.

The hatchery at Cape Vincent, N. Y., was, as usual, supplied with eggs of the commercial fishes shipped from other Great Lakes stations. The output resulting from such shipments comprised 27,000,000 whitefish, 3,572,000 lake trout, and 9,700,000 pike-perch fry, which were liberated in Lake Ontario waters. Attempts made during the season to secure eggs from the various commercial fisheries on Lake Ontario resulted in failure so far as whitefish and lake herring were concerned, but 128,000 lake-trout eggs of fair quality were collected and hatched. The small substation recently established for the collection of pike-perch eggs could not be operated owing to lack of funds.

The Cape Vincent station, owing to its unsuitable location with reference to the sources of egg supply, has practically been a failure. Since its establishment in 1896 the station has simply served as a receiving depot for the development of eggs shipped from other stations. Under instructions from the Secretary, investigations are being made to ascertain if a desirable site can be secured on the shores of Lake Ontario where successful operations can be conducted with the commercial fishes of that region and in connection with which the propagation of pond species also can be undertaken. This will necessitate the acquirement of from 15 to 20 acres of land supplied with a gravity flow of water. In 1908 an appropriation of $7,000 was provided for the purchase of land and construction of a superintendent's residence, ponds, etc., at Cape Vincent, but this money has never been used, and as it is the intention to ask Congress for authority to dispose of the present property when a more desirable site can be found the return of the special appropriation to the Treasury is recommended.

PROPAGATION OF MIGRATORY FISHES OF ATLANTIC STREAMS.

The anadromous fishes of the Atlantic seaboard are handled at two stations in the Chesapeake Basin and two in the Albemarle region, and the principal species handled are shad, striped bass, white perch, and yellow perch.

The run of shad in Chesapeake Bay and tributary streams in the spring of 1914 was smaller than in any previous season within the 35 years covering the Bureau's operations with this species, and the fish-cultural results were correspondingly meager.

On the Susquehanna River preparations were made to cover every field within range of the Battery station where there was a possibility of securing shad eggs by establishing lay-boat patrols in the vicinity of the gill-net operations and detailing experienced spawn takers on the seining shores. The season was a failure, and the total output of shad fry was less than 2,000,000, whereas the efforts put forth and the money expended should have yielded not less than 100,000,000.

As the supply of white perch and yellow perch in the upper part of Chesapeake Bay appears to be increasing, the work with these species was conducted on only a limited scale. Between March 26 and 30, 1914, eggs of the yellow perch numbering 80,762,000 were secured, which yielded 57,400,000 fry and 9,000,000 eyed eggs for shipment to State and private hatcheries. Unusually low temperatures in this river delayed the spawning season of the white perch for about 10 days, but 310,225,000 eggs of that species were collected during the latter half of April and the month of May, producing 218,600,000 fry and 1,450,000 eyed eggs for shipment to New England. In conjunction with the other work, 450,000 alewife eggs were developed as an experiment in the McDonald hatching jars, and from them 184,000 fry were obtained.

On the Potomac River, where the collecting of yellow perch usually starts in February, this work could not be undertaken until the middle of March, owing to the fact that the river was blocked with ice, and the rapidly rising temperatures after that date made it exceedingly difficult to secure sufficient brood fish to produce the usual stock of eggs for the Bryans Point hatchery. However, by constant and persistent effort 15,567 yellow perch had been taken from the fishermen's nets and placed in live cars by March 27, and from them 129,155,000 eggs were obtained. The output for the season was 3,900,000 eyed eggs and 110,224,389 fry, which were distributed in various tributaries of the Potomac River in Maryland and Virginia.

From a financial standpoint the shad season on this river was the poorest ever experienced. None of the commercial fishermen operating haul seines within range of the Bureau's station were able to make expenses, and the catch of fish by the gill-net fishermen was far below the average. Egg collections were made from April 23 to May 20, when the work was discontinued on account of scarcity of fish. The season's work comprised 30,180,000 eggs collected, 27,088,060 hatched, and 611,000 eyed eggs shipped.

In the Albemarle Sound region, where for the past five years the good results of shad propagation and protection have been manifested by a steady and appreciable increase in the annual output of the Edenton station, the work received a check, the output of young shad being only about one-third that of 1913. The poor results may be attributed to several causes, chief among them being the unfavorable weather, which, during the entire spawning season, was too cold to permit of the normal ripening of a large percentage of the fish in the streams. Another unfavorable feature was the unusual scarcity of ripe male fish. At times as many as 100 females with ripe eggs were taken, with only one mature male available, making it necessary to discard eggs in large numbers. The reports received from the lower portion of Albemarle Sound indicated that shad were there in the usual numbers, and it is believed that this setback is only temporary. The total collections of eggs for the Edenton station were 42,885,000, and 29,423,000 fry were the output therefrom.

The hatching facilities of the station were increased during the year by the construction of a new iron-pipe water-supply and drainage system, and the installation of additional hatching tables with a capacity for 200 jars.

Owing to peculiar climatic conditions, the normal spawning season of the striped bass on the Roanoke River, near Weldon, N. C., was prolonged for nearly a month. When egg collections began on April 29 the outlook was discouraging, the catch of fish was small, the river was at a low stage and very clear, and the water was warming so rapidly that numbers of female bass were unduly ripening and casting their eggs in the river many miles below the station. A few days later, following a heavy rain, all these conditions were reversed. The water level in the river was increased over 5 feet, its temperature dropped to normal, and fish with eggs were taken in comparatively large numbers in the vicinity of the various egg-collecting camps. The majority of them were green, however, and male fish, as heretofore, were scarce. At the height of the spawning season (May 12 and 13) over 5,000,000 eggs were taken, and from that time on smaller lots were secured up to May 22, by which date the river was so low and the water so clear that the fish were able to see and avoid the nets. The total egg receipts amounted to 17,290,000 and the output of fry to 11,689,000.

Some penning experiments with the crude facilities at hand were conducted in the course of the spawning season in an effort to solve the greatest problem connected with the artificial propagation of the striped bass—the taking of ripe male and female fish at the same time. Though no positive information on the subject was gained, the results of these experiments gave ground for the belief that under certain conditions the ripening of green fish of both sexes in pens may be successfully accomplished.

CULTIVATION OF MARINE SPECIES.

The hatching of marine fishes and the lobster is done at three stations in Massachusetts and Maine, but the field work for the collection of eggs extends from the Bay of Fundy to Long Island Sound.

The results of the year's operations at the Boothbay Harbor station, though somewhat smaller than had been anticipated in view of the large stock of brood lobsters impounded early in the year, were the largest ever attained on the Maine coast, the number of fry hatched and distributed aggregating 755,557,400.

During the summer and fall of 1913 brood lobsters were so plentiful that 20,349 were collected without difficulty before October, this being more than 3,000 in excess of the number obtained in previous years, even when collections were continued through practically the whole year. It was deemed inadvisable to place more than this number of lobsters in the pound, and as facilities for holding additional stock could not be provided, the collections were discontinued on September 30. On the removal of the lobsters from the pound in April, it was apparent, both from the heavy shrinkage in numbers and from the small crop of eggs carried by the bulk of the females, that too many lobsters had been placed in the inclosure. Only 14,537 survived, the percentage being smaller than in any year since the enlargement of the pound in 1908. The yield of eggs amounted to 150,014,000, or 10,319 per lobster, as opposed to an average of 15,500 in the fiscal year 1913. In the course of the spring 27,642,000 eggs were secured from freshly caught lobsters, and from the total stock 173,500,000 vigorous fry were hatched and distributed.

In order to relieve the crowded condition of the Gloucester hatchery, the steamer *Gannet* was utilized during the early winter in transferring surplus pollock eggs from that point to the Boothbay Harbor station, some of them being carried in scrim boxes in the lobster tank of the vessel and some in transportation cans. While the final results—a total output of 19,233,422 fry from the 88,600,000 eggs handled—would not seem to justify further operations along similar lines, it is believed the experience gained as to the most practicable methods of handling and transferring the eggs will make it possible to prosecute the work on a better basis another season.

Encouraged by the outcome of the haddock operations of the past two years, preparations were made for the propagation of this species on an extensive scale. The season was, however, a failure. Practically no brood haddock were seen, though small immature fish were abundant, and some very good hauls of that size were made by the fishermen. Numerous trips to the fishing grounds in quest of eggs terminated in a total collection of 6,178,000 of very poor quality. From them 894,000 fry were hatched and distributed.

The cod operations at Boothbay Harbor were likewise unsuccessful and for similar reasons. Spawning fish were very scarce on the fishing grounds within reach of the station, and the catch of cod of other sizes was so small as to be unprofitable to the few fisherman conducting operations. The season closed with a total collection of 10,523,000 eggs, which yielded 5,859,000 fry.

In the past years considerable numbers of brood flatfish have been turned over to the Bureau by the cod and haddock fishermen on the Maine coast. Owing to the limited extent of these fisheries the past season no flatfish from that source were available, and the 4,852 spawners constituting the station's brood stock were secured from nets installed and operated by the station force in coves adjacent to Boothbay Harbor and Linekin Bay. Some of the fish were permitted to spawn naturally in the tables, but owing to lack of sufficient table room the greater part were stripped and the eggs artificially fertilized. No difference in results was discernible; the 607,785,000 eggs handled were of uniformly fine quality, and the losses in hatching amounted to only 9 per cent. There being more eggs on hand at the height of the season than could be properly cared for with the available hatching facilities, 100,000,000 were developed in a 10-foot box, which had been divided into five compartments, provided with a scrim lining and scrim bottom, and anchored at the head of the wharf where there was sufficient wave motion to secure a good water circulation through the bottom and the perforated sides of the box. While these eggs developed more slowly than those in the hatchery, owing to difference in water temperature, they hatched just as well and produced fry of excellent quality.

Extensive repairs and improvements, increasing the capacity of the Gloucester hatchery by about 65 per cent, were completed during the early part of the year, and from the opening of the pollock spawning season in November to the end of the fiscal year the station force was constantly occupied in the propagation and distribution of one or more of the five species handled. The total egg collections and the output of fry were the largest in the history of the station, notwithstanding the shortage which occurred in the cod work.

In the prosecution of pollock hatching the schooner *Grampus* was utilized as living quarters for the spawntakers in the field, while the eggs collected were transferred daily from the fishing grounds to the station by the steamer *Blue Wing.* In its early stages the work was not profitable, the collections being small and the eggs inferior in quality. Later, however, their quality improved, and during December the results exceeded all expectations, the daily collections of eggs running from 25,000,000 to 50,000,000. Notwithstanding the increased facilities the hatchery was filled to overflowing, and on several occasions it became necessary to plant some of the older eggs to make room for the enormous incoming collections. The spawning season extended from November 1 to February 6, and resulted in the collection of 974,240,000 eggs. The output included 542,185,000 fry and 116,285,000 eyed eggs transferred to other stations and planted in Gloucester Harbor.

While the collections of cod eggs for the Gloucester station were considerably smaller than those of the previous year, owing principally to the nonappearance of the usual spring run of cod to the inshore fishing grounds in Massachusetts and Ipswich Bays, the number of eggs secured was much larger than the small catch of fish seemed to warrant. During the spawning season—extending from February 1 to April 15—the work was interfered with to some extent by storms, and early in March it became necessary to detach part of the spawntaking force for the collection of haddock eggs. The receipt of eggs for the season aggregated 91,980,000, and the output of fry amounted to 64,780,000.

Between March 17 and April 18 the spawn takers attached to the Gloucester station collected 206,890,000 haddock eggs from the large gill-net steamers operating on the near-by fishing grounds. The eggs were of fairly good quality, but as hatching operations with the cod and flatfish were in progress, it was necessary to crowd them somewhat in the hatching boxes, thus detracting from the results. One lot of 8,590,000 eggs for which there was no room in the hatchery was planted in the harbor near the station, and from the remaining eggs 107,690,000 fry were hatched and distributed.

The flatfish work was attended by more than the average success. From fyke nets set in Gloucester Harbor and fished daily by the station employees from February 24 to April 15, 563 gravid fish were secured, which yielded 275,350,000 eggs. Lack of the usual hatching facilities necessitated the development of a large percentage of these eggs in scrim floating boxes moored in the harbor near the hatchery. The output of fry for the season numbered 242,010,000.

Of 348 egg-bearing lobsters placed in live cars at the station during the fall of 1913, 264 survived confinement and yielded 3,124,000 eggs when stripped early in May. These were hatched in conjunction with 974,000 eggs taken from lobsters delivered at the station during the spring months, and the results in fry distributed amounted to 2,700,000 at the close of the year, with 1,098,000 eggs still in process of incubation.

Notwithstanding the intense severity of the winter and the nonappearance of the usual run of cod on the spawning grounds in Massachusetts fields, a substantial increase over last year in the collection of cod eggs for the Woods Hole station was realized. In November and December brood cod to the number of 3,127 were purchased from commercial fishermen and allowed to ripen in the spawning pool at the station, the capacity of which had been enlarged during the summer and fall. The total yield of eggs from this source was 259,366,000. Late in November the steamer *Phalarope*, with a crew of five spawn takers, was stationed near Sagamore, Mass., for the collection of eggs from the cod fishermen operating in that field. Owing to the climatic conditions encountered, however, only 5,276,000 were secured, and on January 9 the field work was abandoned. In the course of the season 4,130,000 eggs were transferred to the Gloucester station, and from the remaining stock 182,312,000 cod fry were hatched and liberated in the coastal waters of Massachusetts.

While the flatfish operations in the fields operated from the Woods Hole station were greatly retarded by unfavorable weather, and fewer eggs were secured than in the previous year, the final results in the number of fry distributed were over twice as great. The installation of fyke nets for the capture of brood fish was not accomplished in southern Massachusetts until late in January, and there were times during the next two months when the nets could not be operated because of accumulations of ice. The severe weather also delayed the work and curtailed the egg collections on the Rhode Island and Connecticut shores. The eggs from all sources numbered 507,440,000 which produced 373,230,000 fry, a hatch of 73 per cent.

The efforts in connection with mackerel hatching at the Woods Hole station were confined to fields in the immediate vicinity; all available spawn was taken from local traps, and from the 6,521,000 eggs secured 2,510,000 fry were hatched and liberated in local waters

PROPAGATION OF TROUTS AND BASSES.

Spawning operations at the various stations devoted to the propagation of the trouts were highly satisfactory. At the Wytheville, Va., station approximately 2,500,000 rainbow-trout eggs were secured, the largest number ever taken by the Bureau from the domesticated stock of a single station. Substantial gains were also made at the Manchester, Iowa, station in the output of this species, the eggs taken being fully a million in excess of those of the previous year. Collections of eggs from wild rainbow trout in fields contiguous to the Leadville, Colo., and Bozeman, Mont., stations were greatly curtailed by heavy storms and high water in the lakes and streams during the spawning season.

The work with rainbow trout on the Klamath River, Cal., was practically a failure, not because of any diminution in the numbers of brood fish, but because they spawned for the most part in the main river instead of ascending tributary streams where they would have been accessible for egg-taking purposes.

The cultivation of the brook trout in Colorado, which is the only State where extensive collections of eggs are made from wild stock, was conducted under unusually favorable weather conditions, and over 6,000,000 eggs of fine quality were secured. As in previous years, a large part of the brook-trout eggs handled at the Bureau's stations are purchased from dealers, this course having proved more economical in most cases than reliance upon collections from wild fish.

Preparations for the conduct of black-spotted trout work in the Yellowstone Park were taken up in June, but most of the eggs were collected in July. The weather conditions throughout the spawning season were unusually adverse. A succession of storms, very cold water, and high water in all the streams and lakes operated, resulted in a very short collecting period, and only 7,446,060 eggs were obtained, or only a little over one-fourth of the collections of the previous year.

The results of the operations at the various pond-culture stations during the year were in general staisfactory. While there was a slight falling off in the product of the black basses, considerable gains were made in the output of the sunfishes and other species. It is impossible, however, with the present facilities to produce the basses, crappies, sunfishes, and catfishes in sufficient numbers to meet the constantly increasing demands.

While the game fishes constitute a relatively small percentage of the Bureau's output, their cultivation is valuable as an incentive to private fish culture and for the maintenance in public waters of the supply of fishes that may be taken by anglers. The construction of private ponds and the establishment of large fishing preserves are increasing each year, and the Bureau is relied upon to furnish brood stock for such waters.

RESCUE OF FISHES FROM OVERFLOWED LANDS.

The Bureau has continued the work of rescuing fishes from the temporary lakes and pools formed when the Mississippi River and tributaries subside after the annual freshets. Notwithstanding the gradual extension of the field of operations, the collections from this source have for some time been falling off and in places are appreciably smaller than they were a number of years ago. However, the work during 1914 was more favorable than for several seasons past, and 2,500,000 fish of all species were saved, this number being about three times the collections of the previous year. These fishes, which would inevitably have perished from the drying or freezing of the ponds, were for the most part returned to the main streams; but the basses and allied species thus obtained are relied on to supplement the pond-cultural operations, ,and are utilized for stocking waters in the contiguous States and other parts of the country.

The important work inaugurated' some years ago of rescuing from the Chesapeake & Ohio Canal various food and game fishes that become stranded when the water is drawn off in winter, was prosecuted in the portion of the canal between Point of Rocks, Md., and Shepherdstown, W. Va. Approximately 19,500 adult and fingerling large-mouth and small-mouth black bass, crappie, sunfish, white perch, yellow perch, and catfish were taken and transferred to adjacent portions of the Potomac River.

MISCELLANEOUS FISH-CULTURAL ACTIVITIES.

The hatching of pike perch at the Swanton, Vt., station, though considerably retarded by the late spring, was successful. The egg collections were above the average, amounting in round numbers to 134,000,000, and being of very fine quality. The losses during incubation were small. The most gratifying feature of the work, however, was the outcome of the experiment undertaken the preceding year of holding brood fish to ripen in pens constructed along the shores of Lake Champlain. All previous attempts in this direction had met with discouraging results, the green fish so held either dying before the eggs matured or, in case they survived, yielding eggs that were almost if not quite worthless. It may be stated, however, that such attempts were confined entirely to crates moored in the Missisquoi River, most of the brood fish for the Swanton station being taken in those waters rather than from the lake. Very soon after the disappearance of ice in the lake in the spring of 1914 a number of decidedly green fish were captured in seines and transferred direct to the pens. They matured rapidly, there was no noteworthy loss, and the eggs were equal in quality to those obtained from ripe fish captured in the river. Nearly 500 green females were thus matured, and more might have been ripened in this way had it not been deemed inadvisable, in view of the unsatisfactory results in the past, to conduct the experiment on too extensive a scale.

Experiments in the artificial propagation of the buffalo-fishes were continued at the Meredosia, Ill., station during the spring of 1914, but the results were almost negative. The low water prevailing in the Illinois River during the spawning season made it exceedingly difficult to secure brood fish, and only one ripe female was obtained; this yielded 300,000 eggs, from which 150,000 fry were hatched. As noted in former attempts to propagate the buffalo-fish, the fry after hatching seem unable to swim from the jars. However, by placing the fully developed eggs in shallow pans just prior to hatching, the heavy losses from smothering which occur when the fry are held in jars with developing eggs were overcome. It is doubtful if any conspicuous results with the buffalo-fishes can be expected until special hatching facilities can be provided and water of a relatively high temperature insured.

The propagation of shad on the Willamette River near Oregon City, Oreg., has become an established feature of the fish-cultural operations on the west coast, but as yet is conducted on only a small scale. The run of shad in the Columbia River and tributary streams during the spring of 1914 was unusually large. On the Willamette River operations began May 27, and 4,062,000 eggs had been secured up to June 30, with the prospect that the season's output would exceed 6,000,000 fry.

EXPERIMENTS IN ACCLIMATIZATION.

Two interesting reciprocal transfers of aquatic creatures between the Atlantic and Pacific coasts have been in progress for several years, and are now being actively pushed in the belief that definite results of a highly practical value will ultimately, perhaps soon, be achieved.

The Atlantic's contribution to the Pacific is the lobster. In November, 1913, 4,007 adult lobsters, about evenly divided as to sex, were transferred from the Bureau's station at Boothbay Harbor, Me., to Seattle, Wash., in one of the standard refrigerator cars of the American Express Co., an attendant accompanying the shipment to give the lobsters proper care. On arriving at Seattle the lobsters were placed on a Puget Sound steamer and conveyed to the San Juan Islands, where they were distributed in excellent condition off Deer Harbor and Friday Harbor. The total losses in transit were only 440. It is felt that the annual planting of some thousands of adult lobsters in a given locality known to have the requisite physical conditions will result in the establishment of a flourishing colony from which offshoots will naturally spread both north and south, and finally cover an extensive coast line.

In continuation of the efforts to add to the fishery resources of the eastern seaboard by acclimatization of some of the more important food fishes of the Pacific coast, 13,240,000 eggs of the humpback salmon were transferred from Puget Sound, Wash., in October, 1913, for development at the Craig Brook and Green Lake, Me., stations, where special facilities had been provided for handling them. An abnormal loss of eggs and fry occurring at the former station was accounted for by the crowded condition of the hatching troughs; but taking into consideration the large numbers of eggs handled and the fact that they were transported more than 3,000 miles to be hatched, the results of the experiment are regarded as highly successful. The young planted during the fiscal year as fry and fingerlings numbered 7,199,000, and, in addition, 367,900 fingerlings remained on hand at the end of the year and were subsequently distributed. Among the rivers thus stocked are the Penobscot, Androscoggin, Damariscotta, Dennys, Pleasant, Union, Medomak, Georges, and St. Croix.

That the Bureau's efforts to establish the excellent steelhead trout in New England waters have met with success is shown by the increased numbers being taken in the lakes and streams of Vermont. The species has become so well established in Caspian Lake that the State fish commissioner contemplates the construction of a station on the lake for its artificial propagation. Large catches of steelhead have been made in Willoughby Lake and tributary streams in Vermont, a number of specimens weighing up to 6 pounds having been taken from these waters in the spring of 1914. The establishment of the lake trout in Vermont lakes is an interesting outcome of acclimatization experiments. Whitefish from the Great Lakes also have become established in many of the larger lakes of the State and are yearly increasing in numbers.

FISH PONDS ON FARMS.

With the increased cost of living and the growing appreciation of the food value of fish, there is developing a widespread interest in pond culture, both in artificially constructed ponds and in natural inland waters of limited area. This kind of fish culture can be made to produce a ready and economical food supply for the home and to yield also a revenue in conjunction with farming. That such interest is attaining considerable proportions is evidenced by the fact that fully 75 per cent of the 10,502 applications for fish received by the Bureau of Fisheries during the fiscal year 1914 were for species suitable for stocking ponds and other small inland waters.

Much has been done by the Government for the preservation of the country's forests; large tracts of waste land have been reclaimed and made productive through the establishment of immense irrigation plants; water courses have been dammed for the generation of power; and gigantic strides have been made in agriculture and stock raising through the application of scientific methods. In the advancement of these projects, which have such an important bearing on the economic life of the country, the conservation of the fishery resources of the interior have been largely overlooked. Yet the farm lands of the Middle West and of the Eastern and Southern States embrace many thousands of acres unsuited to agriculture which might economically and profitably be converted into ponds for the cultivation of valuable food fishes. It is to this latter enterprise that the Bureau is giving special attention.

It is very common to see ponds, swamps, and small sheets of water lying entirely useless and marshy meadows producing nothing except a small quantity of inferior grass. With a small amount of labor and capital such places might be transformed into ponds which aside from their value for fish culture would be of material benefit to farmers as reservoirs for the storage of water for irrigation during periods of protracted drought. Moreover, the utilization of waste lands in this manner would decrease to a measurable extent the liability of disastrous floods and tend to equalize the flow of neighboring streams.

In many localities ponds can be made by the damming of small ravines or by the diking of small portions of marshy soil depressions. Such lands are of no value for agriculture, and the benefits of their use for the raising of fish would more than offset the expense of the pond construction. The water supply could be provided by diverting the current of some small stream, utilizing the overflow from a spring, or by the construction of windmills and suitable wells.

In ponds so constructed, where the water temperature does not fall below 50° F. in the spawning season, the black basses, crappies, sunfishes, catfishes, and other species can be successfully cultivated with a comparatively small expenditure of time and money.

The Bureau has in many ways endeavored to encourage the raising of food fish on farms; and it will not only supply consignments of young fish for stocking ponds, but will gladly furnish such information as may be needed to insure the success of the undertaking.

If people desiring fish, either for stocking ponds or for public waters, will make the fact known to the Bureau, they will be supplied with blanks upon which to submit formal application, and at the proper distributing season a sufficient number of young fish for a brood stock, of a species adapted to the waters described, will be delivered free of charge at the applicant's railroad station. All that is asked in return is that the fish shall receive adequate attention and protection, and that the applicant submit a report from time to time as to the results of the undertaking.

COOPERATIVE STOCKING OF NATIONAL PARKS AND FORESTS.

The Bureau has undertaken cooperative work with the Department of the Interior and the Department of Agriculture, with the view of stocking with suitable food and game fishes the various waters within the boundaries of the national parks and forests of the country, and a comprehensive plan covering such work has been agreed upon. Prior to this time no definite or sustained policy looking to maintaining and increasing the fish supply in these vast areas had ever been followed; and no adequate attention has been given to the opportunities that are presented for augmenting the attractiveness and usefulness of the national parks and forests.

As regards the following national parks, the Bureau has already made investigations which afford information concerning their present fish fauna and the species whose introduction is best suited therefor: Sequoia, Cal.; Mesa Verde, Colo.; Glacier, Mont.; Crater Lake, Oreg.; Wind Cave, S. Dak.; and Yellowstone, Wyo. It has been determined to make annual distribution of fish for a period of 9 or 10 years in each of these parks. Inasmuch as there have been extensive fish-cultural operations in the Yellowstone Park for a number of years, no additional steps are necessary for maintaining the fish supply in that territory.

No fishery explorations have yet been made in the Yosemite, General Grant, Platt, and Mount Rainier Parks; but as soon as practicable the streams and lakes therein will be examined and the matter of stocking them will receive careful attention.

The arrangements thus far made with the Forest Service contemplate annual plants of fish in some 700 lakes and streams in those portions of Colorado and Wyoming embracing the forest reservations of Arapahoe, Battlement, Big Horn, Bonneville, Bridger, Cochetopa, Colorado, Durango, Gunnison, Hayden, Holy Cross, Leadville, Medicine Bow, Montezuma, Pike, Rio Grande, Routt, San Isabel, San Juan, Shoshone, Sopris, Uncompahgre, Washakie, and White River.

In making distributions in the national parks and forests, the fish will be delivered at the railroad stations nearest the waters to be stocked, and the park superintendents or forest rangers will transport them thence to the waters for which destined. This plan will facilitate the distributions of fish in isolated lakes and streams in the mountains, which could not be reached directly by the Bureau without entailing heavy expense. As the national parks and forests are located for the most part in mountainous districts, the various species of trout are best adapted for stocking them.

SURVEYS, INVESTIGATIONS, AND EXPERIMENTS.

OCEANOGRAPHIC INVESTIGATIONS.

Oceanography, which embraces the biology, physics, and chemistry of the sea, has been used with considerable effect in the elucidation of obscure fishery problems, especially in the North Sea. The Bureau has recently improved its equipment for such work and is systematizing its methods and plan of operation along the lines which experience elsewhere has shown to be effective.

During the summer of 1913 the schooner *Grampus* was engaged in investigations of this character between the Gulf of Maine and the capes of the Chesapeake, incidentally discovering the scallop beds which have been elsewhere referred to. During February and March the Bureau cooperated with the Coast and Geodetic Survey in an oceanographic expedition from the capes of the Chesapeake to Bermuda and thence to the coast of Florida, including several lines of observation across the Gulf Stream as far south as Key West and Habana. These two projects resulted in the collection of a large amount of data and many specimens which there has not yet been time to collate and study. It is evident, however, that the work will not only result in the accumulation of much information in regard to ocean currents, salinities, and temperatures, all of which are important in the distribution of fishes and the determination of the locale of fisheries, but there has been a more direct gain in the knowledge of the spawning grounds, early life, and food of certain species. The physical and chemical data are also of value to navigation through the light which they throw on the direction and velocity of ocean currents.

As the only Government agency having personnel and equipment for such duty, the Bureau was called on in the spring of 1914 to place an oceanographical observer on the revenue cutter *Seneca* engaged in ice patrol and observation on the trans-Atlantic steamship lanes in accordance with an international agreement. The importance of this work appears to have been strongly appreciated by those participating in the International Maritime Conference in London, and it is believed that it will eventually do much to clear up the source and movements of icebergs under the influence of currents. The biological observations as they accumulate and are studied and digested will possibly be better criteria than the physical data, for the plankton organisms, floating plants, and animals, in effect are so many myriad "drift bottles," which can be identified and traced to their source wherever found, while the physical and chemical qualities of the water become confused and blended by the interference and fusion of the various oceanic currents. As most of this work is conducted on or adjacent to the great fisheries of the Grand Banks of Newfoundland, the information acquired will be valuable to the fisheries themselves.

The various phases of work indicated in this section of the report have been so coordinated that, supplemented by the similar investigations in Chesapeake Bay and in North Carolina, elsewhere referred to, they cover practically the whole Atlantic coast from the Grand Banks to Key West, and constitute the most complete and consistent work of the kind which has ever been undertaken in the waters of the western Atlantic.

INVESTIGATIONS OF COASTAL WATERS.

Oceanographic investigations by the fishery schooner *Grampus* having indicated the presence of large scallop beds off the southern New England and middle Atlantic coasts, the vessel was detailed for a more thorough examination, which divulged the existence of this valuable mollusk in commercial quantities in several places. One of the most productive beds reaches to within 40 miles of Sandy Hook, and as it covers a large area and is readily accessible, it is believed that it will eventually support a lucrative fishery. A circular calling attention to the possibilities was issued and widely distributed.

In 1902 the Bureau made a reconnoissance of a fishing bank off Beaufort, N. C., which demonstrated the abundance thereon of sea bass or blackfish. The information was not specifically called to the attention of the fishermen and was not availed of, but during 1913 certain fishermen were induced to try this bank. As an indication of the value of these grounds it may be noted that two fishermen, between June 18 and November 22, made 23 trips 20 miles to sea in a 20-foot, open, power dory, and although they could remain but a few hours on the grounds, they averaged about 600 pounds of fish to the trip. Their minimum catch was 170 pounds, the maximum 1,000 pounds; and in the week ending November 22, in four trips, they took 3,400 pounds, for which they received an equivalent of $238, f. o. b. Beaufort, as the proceeds of a week's work. They have just built and launched a seagoing gasoline boat, with auxiliary sails, which will enable them to remain on the fishing grounds overnight and much increase the efficiency and profit of their operations.

The outlook was regarded as favorable to the development of a remunerative sea-bass fishery, and the steamer *Fish Hawk* was detailed for further examinations. A number of other banks were found and reported on, and a circular was issued furnishing information as to their location and productiveness. At the end of the fiscal year arrangements were made to place a buoy on the principal bank to assist the fishermen in locating the most productive grounds.

During the winter and spring of 1914 the *Fish Hawk* carried on a series of biological and physical investigations of Chesapeake Bay in connection with a study of the habits and distribution of the fishes of the region. Some significant and unexpected facts concerning the distribution of the salinities and temperatures of the water were developed, and there is strong indication that the continuance of the work will show the causes for a heavy winter death rate among the young fishes and the reasons for irregularities and deficiencies in the annual runs of the shad and other anadromous fishes. In connection with this work, facilities were furnished on the *Fish Hawk* to the Department of Agriculture for a sanitary survey of the oyster beds, a subject of much importance to the public and the oystermen.

The presence of the halibut off the coast of Oregon and Washington having become known, the fishermen of those States requested an investigation to determine whether the supply was sufficiently abundant and regular to warrant equipment for a large fishery. Accordingly, in the spring of 1914, the repairs to the *Albatross* having been completed, that vessel, with her regular personnel and a party of experienced halibut fishermen, was ordered to make a survey, employing both her regular equipment and the practical gear of the commercial fisheries. The work was interrupted in June, but resumed later in the summer and prosecuted until the weather forbade. The results so far attained do not indicate the continuous occurrence of large bodies of halibut off that part of the coast, but the determination of even this negative fact will be valuable by preventing unwarranted expansion and needless expenditure by the fishing interests.

In connection with the recently developed commercial fishery for the small tuna, or long-finned albacore, in southern California, the fishermen and canners are growing concerned as to the volume and continuance of the supply. To determine the facts and, if possible, to discover more extensive bodies of fish offshore, the Bureau, at the urgent request of those engaged in the business, has undertaken an investigation. It was commenced near the close of the fiscal year by an assistant operating from the shore, but it will be taken up by the *Albatross* at the close of her halibut survey and will be continued throughout the current year.

The shrimp of the Gulf and South Atlantic coasts supports one of the most important of the minor marine fisheries, and in certain regions the supply shows indications of depletion. Nothing is known of the spawning and very little of the other habits of this crustacean, and to serve as a basis for regulative legislation and other possible measures of conservation a study of the natural history of the species was commenced near the close of the fiscal year.

INVESTIGATIONS OF LAKES AND STREAMS.

The investigations of lakes in Washington and Idaho, begun during the fiscal year 1912, were brought to a close pending the submittal of the report of the investigators and an analysis of the scientific and practical results. The report has not yet been completed, but preliminary memoranda indicate that it will contain matter and recommendations of value to fish culture, particularly as a guide to the species of fishes which it will be profitable to plant in those waters.

In Wisconsin, where the Bureau is cooperating with the State Geological and Natural History Survey in an investigation of the lakes, the work is being conducted in great detail, and with strict attention to scientific accuracy in an attempt to discover the fundamental, physical, and biological conditions of lacustrine life. This research, which requires but a small expenditure, under the cooperative arrangement, will eventually establish a foundation for the better understanding of lake phenomena in other regions.

A biological and fishery examination of Lake Champlain, commenced during the year in cooperation with the Vermont State Fish Commission, was suspended at the close of the summer, but will be concluded during the next fiscal year. It has as its primary purpose the determination of the feasibility of establishing a commercial fishery for certain species of fishes without detriment to the sporting interests on the lake which are a valuable asset to the people of Vermont and New York.

Minor inquiries were conducted in Tuxedo Lake, N. Y., in respect to the maturation and spawning of chinook salmon, and in the small lakes and artesian-well ponds of North and South Dakota to determine their suitability for the planting of fishes. The latter work was not completed, owing to the resignation of the assistant assigned to it.

The construction of the great dam in the Mississippi River at Keokuk, Iowa, has resulted in the production of a long narrow body of water known as Lake Cooper, which in its general physical characteristics resembles Lake Pepin, a natural expansion in the course of the same stream in Wisconsin and Minnesota. In its fisheries Lake Pepin is the most productive part of the Mississippi River, and it appears probable that with proper treatment the new artificial lake may be equally valuable and serve a useful purpose supplemental to its primary use for hydroelectric power generation. To supply the information necessary to aid steps to this end, the lake has been placed under observation, and at the end of the fiscal year arrangements had been made for the investigation of the plants and microscopic animal food. It is hoped that the results will be sufficiently favorable to warrant the planting of fishes and larval mussels therein during the current year. Coincident with this work a study was made of the effects of the dam and locks on the movements of migratory fishes, in the expectation, already partly realized, of adding to knowledge respecting the general principles of a successful and efficient fishway.

Continuing the survey of the fresh-water mussel resources of the Mississippi Valley, investigations were conducted in the upper Missouri River drainage system and in the Ohio River valley. The latter inquiry is in progress at the close of the fiscal year. The publications embracing the results of this series of investigations have been very favorably received by the pearl-mussel interests, and in some cases have opened new fields to industry. In connection with these studies and the deductions based on them, the question of the protection of the mussel fisheries has received critical attention, and a report on constructive and conservative legislation has been issued and brought to the attention of the authorities of the States having mussel resources.

Of interest to fish culturists are the experiments being conducted at Homer, Minn., to determine the feasibility of propagating amphipods, or water fleas, in sufficient quantities to be economically available as food for young fish, of which they constitute a natural diet.

The study of the salmons of the Pacific coast has been continued, and in June, 1914, a temporary assistant was employed to take up systematically an inquiry into the life history of the species of the Sacramento and Columbia Rivers mainly through the study of the scales, the new means which science has placed at the disposal of such inquiries.

FRESH-WATER MUSSEL CULTURE.

The propagation of fresh-water pearly mussels, which is a recent development of the Bureau's work, already has assumed important proportions. In this the second year of its active prosecution, 227,536,814 glochidia or larval mussels were planted, an increase of 50 per cent over the output of the preceding year. Of these 86,026,000 were planted in the Mississippi River in the vicinity of Fairport, Iowa; 7,316,000 in the same stream near La Crosse, Wis.; 101,136,200 in Lake Pepin, Minn.; 8,840,000 in Black River, Ark.; 4,726,000 in White River, Ark.; and 19,258,000 in Wabash River, Ind., in addition to which smaller experimental plants were made in Grand River, Mich.; Lake Pokegama, Minn.; and Maumee River, Ind.

As is now generally known, these larval mussels are parasitic on fishes, and to carry the number of glochidia indicated 167,819 fishes were infected and liberated in the streams. Of this number 66,645 were rescued from the overflowed lands, where they would otherwise have perished, and as these were all adults, and in most cases valuable species, this number of breeding fishes was incidentally saved for the maintenance of the food supply of the streams in which they were placed. This in itself would almost warrant the expenditure incurred, but disregarding it, and charging all expenses to mussel culture alone, the cost of the glochidia planted in the streams was 4.3 cents per thousand, as compared with 7 cents in the preceding year. This includes, in both cases, overhead charges for maintenance and depreciation of the plant employed and supervision of the work. These statistics are presented, not to show the value of mussel culture, but to indicate that it is being conducted on such scale and with such efficiency as will measure its utility in due time.

Those engaged in the fishery already report an increase in the abundance of young mussels on the beds, and they attribute the fact to the Bureau's operations, but those in charge of the work believe that it will be several years at least before conclusive evidence of the benefits will be available. It should be remembered, moreover, that while the larval mussels are planted in more or less circumscribed localities in the Mississippi River system, the fact that they are carried for several weeks by more or less strong-swimming and nomadic fishes assures that they will be given more general distribution than a mere statement of the places of deposit would indicate.

The scientific investigations conducted at the Fairport laboratory, elsewhere reported, are gradually improving the methods of mussel culture and making it possible to propagate valuable species which for lack of knowledge presented difficulties when the work was initiated. The experiments have in fact reached a stage where the practical cultivation of certain valuable mussels can now be instituted, and special financial support for this work is provided for in the appropriations for the fiscal year 1915.

POLLUTION OF WATERS.

The matter of the pollution of lakes and streams each year is attracting more attention from both sanitary and industrial viewpoints, and the demands for investigation and relief which the Bureau receives from fishermen, sportsmen, and the general public yearly become more numerous and insistent. While the Bureau has not been provided with the necessary means for properly performing its duty in this respect, it has made every effort to do what is possible and has carried on several investigations during the year.

The research conducted in the Illinois River in cooperation with the Illinois Natural History Survey, with particular reference to the effects of the discharge from the Chicago Drainage Canal, was brought to a successful conclusion during the year by the publication of a valuable report at the expense of the State. This renders available much new data bearing on the effects of sewage pollution of streams, and the results to the fisheries and its findings are in general applicable to other streams carrying large quantities of domestic and municipal sewage.

Complaint having reached the Bureau that oil refineries and tank steamers were polluting the Delaware River to the detriment of the fisheries, a brief inquiry was made into the facts. It was found that some of the refineries discharged but little oil into the stream, but that the "separators" of others were inadequate or inefficiently operated, with considerable resultant contamination of the water. No oil steamers entered the river during the inquiry, but there is but little doubt that more or less oil is discharged when the water ballast is pumped from the tanks after they pass the breakwater at the mouth of the bay. As no fishery of importance was being conducted at the time, the effects of the oil, which was spread on the water in films of considerable area, could not be ascertained. It is probable that it affects the salability of the fish rather more than their movements and distribution.

During the spring an investigation was made into the newspaper and personal allegations that the Government powder factory at Indian Head, Md., was discharging substances which have killed large numbers of fishes in Mattawoman Creek and the adjacent part of the Potomac River. It was found that while the materials complained of were toxic to fishes in solutions of considerable attenuation, no fish were being killed by the normal quantities being discharged at the time of the examination, and that sunfishes were spawning on the creek at a place opposite the point of discharge. It appeared that excessive discharges, and even the normal discharges at times of low water, might prove dangerous; and representations to that effect having been made to the Secretary of the Navy, measures were taken to remedy the conditions.

EXPERIMENTS IN TERRAPIN CULTURE.

Although the feasibility of breeding and raising terrapin under artificial conditions in inclosures has been demonstrated at the Beaufort, N. C., laboratory, experimental work has been continued for the improvement of methods of feeding, testing the possibility of developing a superior race for breeding, and for other purposes important to the commercial success of terrapin farming. It has been found that while the rapidity of growth can be stimulated by winter feeding and the prevention of hibernation, there is considerable individual variation in the rate of growth, and it is believed that by breeding from the more forward individuals there may be developed a culture strain which will reach a merchantable size at a considerable earlier age than the average in a state of nature.

The Bureau has furnished specimens of its young terrapin for experiment and observation in Florida, to determine whether the more valuable northern species will live and thrive under southern climatic conditions, and it has liberated several hundred yearlings and 2-year-olds in a circumscribed locality in Chesapeake Bay to test the feasibility of restocking depleted natural waters.

The results obtained at the Beaufort laboratory have been sufficiently promising to enlist private capital, and there is now established near there a commercial farm with a breeding stock of several thousand. Although these brood terrapin were brought together after the breeding season was well advanced, about 700 eggs were deposited and hatched. On the advice of the Bureau's terrapin culturist the young were fed during the winter on fresh food, and in consequence their growth has far exceeded that of the experimental broods fed on salt fish, although the mortality was somewhat higher, probably from overfeeding. The results to date are such as to confirm belief in the commercial profit of terrapin farming.

THE FISHERIES LABORATORIES.

Woods Hole, Mass.—The investigations of the sea mussel and the dogfish were continued during the summer of 1913, and the practical campaign to induce the commercial utilization of these waste sea products is referred to elsewhere in this report.

Through the service of temporary employees a number of other investigations were conducted, among them an inquiry into the cause of "green gill" in oysters, an affection which, while harmless, causes much loss to oyster growers by destroying the salability of their product on account of the prejudice of the public against the consumption of the oysters affected. Studies were also made of the life histories of the drill and other oyster enemies in the hope of discovering some stage or habit through which they may prove vulnerable to measures for their destruction.

To secure definite experimental knowledge for use in the correction or prevention of water pollutions inimical to fishes, tests were made of the toxicity of various mineral matters likely to find their way into streams, and as opportunity offers the studies will be extended to other common water contaminations. There is a growing public demand for specific information of this character.

Correlated with this subject was a research into the oxygen requirements of fishes. Sewage and other decaying organic matter by its oxidation reduces the free oxygen in the water, and in that way may either kill fishes or drive them away. The subject may also be of importance in preventing the wasteful use of water at hatcheries.

Beaufort, N. C.—During the year this station was given some much-needed repairs, the buildings were repainted, a new gasoline-motor launch, with accommodations for extended trips, was provided, and the general equipment was increased and improved in a number of ways conducive to efficiency.

In the preceding year a considerable accretion from harbor-dredging operations had been made to Pivers Island, on which the laboratory stands, and this material was regraded and fixed by planting grass and constructing windbreaks, with the result that the Bureau's property available for buildings and general purposes has been very materially increased.

The experiments in diamond-back terrapin culture, and the exploitation and location of the fishing grounds by the steamer *Fish Hawk* while detailed to the station, have been mentioned elsewhere, with their attendant commercial results.

The southern flounder, an excellent food fish, having been discovered in spawning condition, an experimental hatching apparatus was set up for use during the spring of 1914, but no ripe fish could be obtained. It is purposed to continue the experiments with the flounder and other commercial fishes, and, if possible, to utilize the plant as a fish hatchery, particularly when its other activities are at a minimum.

During the summer of 1913 the methods of the scientific work of the station were partially reorganized so as to bring them into closer accord with the other activities of the Bureau. The researches have been more closely coordinated, so as to attack the several problems from various sides simultaneously, and utilize more advantageously and with less effort the facilities and material available.

Special attention was paid to the collection and classification of data relating to fishes, their distribution in the region, their movements, food, enemies, spawning, and growth. Complete records were obtained of the time of spawning and the embryological and larval growth of two species, and incomplete histories of six others. To secure data for legislative purposes, critical studies of the rate of growth of fishes and the relations of weight to size at different ages were undertaken, and the work on the determination of the ages and other facts of the life histories of fishes, as revealed by the scale markings, was continued from the preceding year. These latter researches offer a most promising means for revealing facts, a knowledge of which is necessarily antecedent to effective measures for fisheries conservation. The study of the food and feeding of fishes was undertaken by several investigators, each studying a special group of organisms. Interesting results were obtained from experiments to determine the extent and character of the flounder's adaptation of its color to its environment, and the work will be continued to establish to what extent the color modifications serve as a protection to the fish.

The edible crab supply is apparently becoming depleted, but its habits are not sufficiently well known to make it possible to propose conservative measures without danger of unnecessarily injuring the fishery. To endeavor to supply part of the needed information, a temporary assistant began studies and experiments during the year.

For several summers tests have been conducted at the laboratory to determine the feasibility of protecting wood from marine borers by impregnating it with solutions of metals and other substances. At the end of the fiscal year cooperative arrangements were established with the Forest Service for the further prosecution of the work.

Owing to delay in passage of the annual appropriation bill, the operations of the laboratory near the end of the fiscal year were seriously interfered with by uncertainty as to funds for the continuance of such work as might be begun.

Fairport, Iowa.—This station, which combines the facilities of a laboratory for research and experiment with the equipment of a station for extensive practical work in fish and mussel culture, is now complete in all its essential features, and its further development will consist mainly in the extension of its equipment and activities. The fisheries of the Mississippi Valley have never reached the development of which they appear susceptible, nor have they received at the hands of the Bureau the study, experiment, and close attention which must be antecedent to their rational conservation and legitimate increase. In large measure this has been due to the absence of close continuous contact between this office and the fishery interests, and the consequent lack of a full understanding of the conditions and requirements. This deficiency the Fairport station now corrects and the effect is already apparent in the confidence and interest which the people are exhibiting in the work, and the more direct and economical application of the Bureau's activities to the regional requirements. It is the purpose to extend the benefits of the station to the entire Mississippi Valley by making it the center for all activities not connected with the regular fish-cultural operations.

In addition to the fisheries work, with which the Bureau is directly concerned, it is proposed to make the laboratory of general scientific and educational value by extending its facilities, under proper regulation, to qualified investigators in the realm of fresh-water biology.

The station, which occupies a reservation of about 60 acres, is equipped with good laboratory facilities for biological and chemical research, ponds and tanks for experimental and practical fish and mussel culture, an efficient pumping plant, and copious supply of crude and filtered water, a practical shell-testing plant and machine shop, launches, boats, and fishing gear, and the living accommodations for employees, made necessary by the inadequate accommodations of the adjacent community. In addition to mussel culture on a large scale, investigations of mussel resources of various streams, a study of the effects on the fisheries of Keokuk Dam and the possibilities created by its backwater in Lake Cooper, and a canvass of the extent and value of the mussel industry, various scientific researches were conducted at the laboratory. The general conditions under which three important species of mussels may be propagated were practically established, and some progress was made in rearing young mussels beyond the parasitic state and in determining the rate of growth of both young and adults. These researches enlarge the field of practical mussel culture.

Experiments to discover a use for large quantities of mussel meats, now wasted; investigations into the conditions controlling the production of lustrous, and therefore valuable, shells; and studies of the food of mussels, and of their parasites, were carried on as part of the progressive and constructive work necessary to a full utilization of the mussel resources of the country.

FUR-SEAL SERVICE.

The administration of affairs on and connected with the Pribilof Islands has been conducted in accordance with law and regulations. The annual supplies required for the maintenance of Government property and for the support of the native inhabitants were delivered in the early part of the year. Medical attention has been furnished the natives, and excellent schools have been maintained for the native children.

After giving careful consideration to the relative advantages possessed by San Francisco and Seattle as bases for the purchasing of annual supplies for the Pribilof Islands, the latter city was selected. A private steamer was chartered to take the supplies, and left Seattle in the latter part of June, 1914.

The wireless station maintained by the Navy Department on St. Paul Island was in operation throughout the year. This station, by furnishing a means of communication with that island, is almost indispensable, especially in the late fall, winter, and early spring, when no vessels go to or from the islands. The Navy Department has also a small station on St. George, which enables that island to keep in communication with St. Paul. During a considerable part of the year the St. George station was in charge of G. Dallas Hanna, who voluntarily assumed this duty in addition to acting as school teacher.

The killing of fur seals on the Pribilof Islands was limited to young males needed for supplying food to the native inhabitants. The Secretary authorized the utilization of 3,000 for this purpose during the season of 1913, and later, in the fall and winter, gave permission to take additional seals. The seals killed fell short of the limit. The annual shipment of skins, made in August, 1913, on the chartered vessel that carried supplies to the islands, comprised 2,296 skins. These were landed at San Francisco, and shipped thence to St. Louis, where most of them were sold at public auction on December 16, 1913.

All previous sales of fur-seal skins taken under the immediate supervision of the Government on the Pribilof Islands had been conducted in London. In 1913 the Department, after giving due consideration to all phases of the question, decided to initiate the selling of the skins in this country. The number of skins to be sold was relatively small, and for that reason the occasion was considered favorable for making what was in some measure an experiment. It was felt that if the Government could realize even approximately the same net returns from the sale of the skins in this country as might accrue from their sale in London, the establishment of an American market was demanded by sound economic principles.

At the request of the chairman of the House of Representatives Committee on Expenditures in the Department of Commerce, 400 of the skins were withheld from sale. The remainder, numbering 1,896, brought $5[illegible],579 gross, and about $50,950 net. The fur trade of the world being unsettled at the time and many of the skins being of rather poor quality, the result of this experiment was regarded as entirely satisfactory. The sale attracted much attention and was attended by many buyers from Europe and America.

In the summer of 1913 a special investigation of the fur seals on the Pribilof Islands was made by George A. Clark, who had conducted similar investigations on a number of previous occasions. The results of his enumeration of the seal herd were given in the last report of the Bureau, although the work was not completed until the fiscal year 1913–14. The figures showing the components of the herd in the summer of 1913 are here given:

Active bulls, with harems (actual count)	1,403
Idle and young bulls (actual count)	364
Bachelors, 1, 2, 3, and 4 years old (count and estimate)	47,000
Cows, 1 and 2 years old (count and estimate)	35,000
Breeding cows (equal to pups)	92,269
Pups (actual count)	92,269
Total	268,305

The North Pacific Sealing Convention of July 7, 1911, effective December 15, 1911, and the act of August 24, 1912, giving effect to that convention, permit Indians dwelling on the western coast of North America to take fur-seal skins under certain conditions. As far as this Bureau is advised, no skins have been so taken by the Alaska Indians since the convention became effective. In April and May, 1913, Indians dwelling on the coast of Washington secured 91 skins, and the Department of the Interior has advised that in April, 1914, those Indians secured 14 skins. Reports as to the sex of the seals from which these skins were taken show that for 1913 ninety were females and for 1914 twelve were females.

Due effort was made to enforce the prohibition upon pelagic sealing and, it is believed, with success. Throughout the season when pelagic-sealing operations were possible, the United States Revenue-Cutter Service has maintained an efficient patrol for the prevention of such operations, three vessels being assigned to the work in 1913 and 1914. These vessels also render great service to the Bureau in connection with its administration of the Pribilof Islands by transporting mail, officials, and limited quantities of supplies. Early in the calendar year 1914 there came to the Bureau information which seemed to indicate that certain persons contemplated engaging in pelagic sealing during the coming season. Orders were issued promptly to various officers of the Bureau to inform themselves regarding any plans to carry on illegal sealing operations and to keep the Bureau fully advised in reference to the matter. Nothing definite was learned, however, in reference to any proposed illegal operations.

In January, 1914, the Commissioner of Fisheries recommended to the Secretary the nomination by outside agencies of three duly qualified persons, not previously identified with fur-seal matters, to whom should be intrusted a full investigation of the fur-seal herd. This was done that the Department might have for its guidance and be in position to submit to Congress data and recommendations regarding the Alaskan seals which would not be open to criticism as coming from persons who had been parties to the long controversy and who might therefore be regarded by Congress as committed in advance to a particular line of policy. It was felt that those who had investigated the subject, and had frequently made known their findings and views, would welcome a new inquiry, the verification of the facts established by previous scientists, and recommendations based on the new conditions that are now affecting the herd. Pursuant to this recommendation the Secretary requested the Secretary of Agriculture and the Secretary of the Smithsonian Institution each to name an expert, and the President of the United States invoked the aid of the National Academy of Sciences to the same end. In due time the nominations were made, as follows: By the Secretary of Agriculture, Edward A. Preble, of the Bureau of Biological Survey, Department of Agriculture; by the Secretary of the Smithsonian Institution, Wilfred H. Osgood, of the Field Museum of Natural History, Chicago; by the National Academy of Sciences, Prof. George H. Parker, of Harvard University. Formal appointment of these gentlemen as special assistants was made, full individual and joint instructions were issued, and they left for the seal islands on a revenue cutter sailing from Seattle early in June, 1914. A detailed report, with recommendations, is expected from these assistants as soon as their inquiries are completed.

Independently of the dispatch of these special investigators on behalf of the United States, the British and Japanese Governments intimated their desire to send experts to the seal islands, and the Bureau took steps to provide transportation and other facilities therefor.

MINOR FUR-BEARING ANIMALS OF ALASKA.

Owing to a defect in the act containing the appropriations for the Bureau, considerable embarrassment was experienced at the beginning of the fiscal year in regard to the enforcement of the law protecting the fur-bearing animals of Alaska. The act contained no authority for expenses of the warden service, but a later deficiency bill made available a certain sum for this purpose, and the work thereafter was pushed actively. A number of cases of violations of law and regulations including the killing of beaver, the poisoning of foxes, and the possession of unprime skins—were successfully prosecuted.

The recent impetus given to the business of rearing fur-bearing animals in captivity resulted in numerous requests for permission to capture animals in the close season for use for such purposes. The Department decided that the proper development of the fur-farming industry in Alaska demanded that some provision be made for the taking of certain fur-bearing animals for use for breeding purposes in Alaska during a portion of the season when the killing of such animals is prohibited. By the revised regulations for the protection of fur-bearing animals in Alaska, promulgated as Department Circular No. 246, second edition, under date of June 22, 1914, the taking alive of land otter and mink for use for breeding purposes in Alaska is permitted except in the season from April 1 to June 30, both days inclusive, of each year; and of foxes and marten except in the season from March 15 to June 30, both days inclusive, of each year. It is assumed that the wide latitude allowed for the taking of these animals for breeding purposes in Alaska is amply sufficient for the needs of all persons who may engage in breeding and raising those animals in that Territory.

The revised regulations also require that all persons engaged in Alaska in the business of breeding and raising fur-bearing animals in captivity shall first obtain from the Department of Commerce a license for that purpose. Permits will be issued to the owners and operators of such licensed fur farms or ranches in Alaska authorizing them to ship their ranch-bred stock from the Territory of Alaska.

In view of the injury done to the animals on the Afognak Reservation by the eruption of Mount Katmai, it has been decided to establish an absolute close season for foxes and land otters for a series of years. Under the terms of Department Circular No. 252, issued October 29, 1913, the pursuit, capture, or killing of foxes within the reservation is prohibited until November 16, 1918, and of land otters until November 16, 1915.

During the fiscal year formal permits relative to fur-bearing animals were issued as follows: (*a*) three permits authorizing the shipment of black bears from Alaska; (*b*) one permit authorizing the shipment of lynx from Alaska; (*c*) two permits authorizing the shipment of marten from Alaska; (*d*) one permit authorizing the collecting of specimens for the use of the Museum of Comparative Zoology, Cambridge, Mass.; (*e*) 31 permits authorizing the shipment of ranch-bred foxes from Alaska, the permits being issued to 16 different parties and covering 910 foxes; and (*f*) one permit authorizing the shipment of silver-gray foxes from Alaska (source of foxes not stated).

Twelve islands lying off the Alaskan coast have been offered for lease, for fox-breeding purposes, for periods of five years, in accordance with law and pursuant to Executive Order dated February 2, 1904. In response to a circular announcement issued in 1913, bids for Little Koniuji Island and Carlson Island, at $205 and $200 per annum, were received and accepted. A second circular announcement dated January 1, 1914, inviting proposals for leasing the remaining 10 islands, resulted in bids for 3 islands at $200, $205, and $250 per annum which will probably be approved. The offer of the Department to supply blue foxes for breeding purposes from the herds on the Pribilof Islands elicited a number of competitive bids, the highest being $151 apiece for selected animals. Some deliveries have been made, but the plan presents a number of difficulties connected with the shipment of the foxes from the islands and the care of them in transit.

A limited number of blue foxes were taken from the Government herds on the Pribilof Islands in the winter of 1912–13, and their pelts shipped to St. Louis and sold at public auction. The skins numbered 436, and brought $17,552.

The present general law for the protection of fur-bearing animals in Alaska has been found quite inadequate in many respects for the purpose for which it was intended. This law forbids only the actual killing of those animals and does not clearly empower the Government to take certain steps necessary to check operations of various kinds quite as detrimental to the conservation of those animals as the actual killing would be. The Government should be specifically empowered to regulate the capturing of fur-bearing animals so as to prevent the needless destruction of burrows, to prevent the taking of fox pups by irresponsible parties under circumstances which inevitably result in the death of numerous young ones, and to take other rational steps which are recognized by every informed person as necessary to protect the various species of fur bearers. The Department is endeavoring to conserve and extend in every proper way the fur industry of Alaska. This applies both to the preservation of the natural wild stock (which must furnish a not inconsiderable portion of the means of livelihood to many of the natives of Alaska) and to the building up of an additional fur industry through the domestication of fur-bearing animals under private auspices. It is hoped that a bill drafted by the Bureau and now pending in Congress, which meets the existing situation, may speedily be enacted into law.

ALASKA FISHERIES SERVICE.

The Bureau has labored to enforce the law and regulations for the protection of the fisheries of Alaska to the full extent of the facilities provided by Congress. During the fishing season of 1913 a number of fur wardens and employees in the fish-cultural branch of the service were detailed to assist in this work.

In the summer of 1913 the Bureau was enabled to utilize for the first time a vessel of its own for inspection work. This vessel, the *Osprey*, purchased the previous year, is a steam craft 72 feet in length, and carries a crew of six men. During the winter of 1912–13 it was kept at Semiahmoo, Wash., but in July, 1913, it was put in commission and at once proceeded to Alaska where it has been in continuous service since.

During the period of most extensive salmon fishing operations in southeast Alaska, a special patrol was maintained for securing enforcement of the law and regulations. In addition to the *Osprey*, there were employed on this patrol a number of private power boats chartered by the Bureau for short periods, and a launch attached to the Yes Bay hatchery rendered service in waters adjacent to that station. Arrangements were made to continue this patrol work under similar lines in 1914. This is the only part of the long coast line of Alaska on which even an approximately satisfactory enforcement of law is possible.

The usual census of red salmon ascending Wood River was taken in 1913, and indicated an increase in the run amounting to 100 per cent as compared with 1912. The figures, however, are not conclusive, and should be supplemented by observations for later years. Arrangements were made for a continuation of this census in 1914, but delay in the passage of the appropriation bill and lack of authority to incur liabilities in the absence of appropriation caused the abandonment of the work, much to the regret of the Bureau.

In the latter part of April, 1913, there was begun under the joint auspices of the Bureau of Fisheries and the Association of Audubon Societies a biological survey of Forrester Island, which lies off the coast of Alaska near the southern boundary of the Territory. The investigation was in charge of Dr. Harold Heath, and was continued until August 15. Forrester Island is a Government reservation under the control of the Forest Service, with a warden detailed from the Biological Survey. The warden has power to issue or refuse fishing permits, to enforce the fishing regulations, and to rid the islands of objectionable characters. The number of permits last season was limited to approximately 300, and the number of power boats to 25. The fishery problem of the island, however, is the competition between the power boat and the rowboat fishermen, the latter being the native Indians, who are at a great disadvantage against the more efficient equipment of the white men. Some lawlessness on the part of the power-boat men, moreover, and dissatisfaction with the warden, complicated the situation, creating hardship to the natives, and generally unsatisfactory, even unsafe, conditions. Regarding the power boat and the hand trollers as irreconcilable elements under existing conditions, the investigator recommends the elimination of the power boats, in the interests of the greatest good to the greatest number.

Attention was given to all of the most important fishes of the locality, of which the king salmon is chief. Since copepods constitute the principal or only diet of the sand launce, black cod, and herring, which in turn are food of the king salmon, it is considered obvious that the migration of copepods is one of the most important unsolved problems connected with the fisheries of Alaska. As this migration is far more definite, clean-cut, and free from modifying influences in the region of Forrester Island than elsewhere, it is strongly recommended that thorough and exact study of this subject be made.

The magnitude of the fisheries of Alaska and the vast potential supplies of aquatic products which are involved in the conservation of the fishery resources merit the expenditure of much larger sums than have as yet been provided. The weighty responsibility imposed on the Bureau in connection with this industry makes it the urgent duty of Congress to grant the necessary personnel and other facilities.

A full account of the extent and condition of the Alaskan fisheries has been published in a special report. It may be noted here that in 1913 this industry gave employment to upward of 21,700 persons, including over 4,000 natives; the investment in fishing property exceeded $37,000,000, of which $34,953,000 represented the salmon industry; and the products were valued at about $15,740,000. The yield of salmon aggregated 59,915,000 fish, from which there were prepared 3,739,000 cases of canned fish, valued at $13,531,000, and miscellaneous products, valued at $917,000. Fewer canneries were in operation than in 1912, and there was a decrease in the salmon yield and in the canned ouput.

Five private salmon hatcheries were operated in Alaska in 1913, and these liberated 77,997,000 fry of the red salmon. This output earned for canners tax exemptions on canned fish aggregating $31,197 in the fiscal year ending June 30, 1913.

MISCELLANEOUS AFFAIRS AND RELATIONS.

NEW ESTABLISHMENTS.

A site has been selected for the new fish-cultural station in Utah at Springville, Utah County, and steps have been taken looking to the acquisition of the property.

Preliminary inquiries have been made regarding possible sites for the new fish-cultural station authorized for Rhode Island. The State legislature at its last session passed an act giving the United States Commissioner of Fisheries and his duly authorized agents the right to conduct all needed operations in connection with the hatchery.

Title to the property required for the new hatchery in Wyoming has finally been secured, and construction work will soon be begun. By deeds dated April 17, 1914, 40 acres of land and the required water rights have been secured at a cost of $800 and $1,200, respectively. The site is 3½ miles north of Saratoga, in Carbon County, on the line of the Saratoga & Encampment Railway, which connects with the Union Pacific at Walcott. Water is to be obtained by piping from Lake Creek Lake and a flow of about 1,000 gallons a minute is assured.

After the most searching investigation extending over a number of years and participated in by various officials of the Bureau, the vicinity of Key West, Fla., has been determined on as the best location for the marine biological laboratory already authorized by Congress, and a site has been selected. Legislation was, however, necessary to acquire the property by direct donation, and an item to this end is contained in the sundry civil appropriation act for 1915.

At the Louisville, Ky., station two pump houses have been completed and equipped with electrically driven pumps with a capacity of 600 to 900 gallons each per minute. The pump houses are 18 feet square, are of frame on a concrete base, and cost $2,800. A steel storage tank and tower holding 25,000 gallons has been erected. Two stock ponds have been finished, three more are under construction, pipe connections are made, the grounds have been improved, and roadways and paths have been constructed. The appropriation has been exhausted, and $30,000 will be required to complete the station in accordance with plans.

At the Orangeburg, S. C., station a superintendent's residence 33 by 36 feet was erected by day's labor at a cost of $6,068.34. It is a two-story frame structure on a concrete foundation, containing 7 rooms and bath, and with cellar and attic rooms. A frame workshop, containing office and storeroom, has been built. For the partial development of the station six brood ponds were partly finished, the main drains were laid, and a concrete outlet was built. The original appropriation has been entirely expended, and $25,000 additional will be needed to complete the station.

PACIFIC COAST OFFICE.

The activities of the Bureau on the Pacific coast are extensive and diverse, and are yearly becoming more important. It has therefore been decided to establish a branch office in Seattle in order that closer relations may hereafter be maintained with the fishery interests with which the Bureau has to deal. It is proposed to assign an experienced assistant to take charge, and to make the office a center for collecting and disseminating information regarding all fishery matters of interest to the Pacific States and Alaska. The fishery, fish-cultural, scientific, and general administrative work of the Bureau in that region will have headquarters here, and increased economy and efficiency should result.

ALEUTIAN ISLANDS RESERVATION.

Under the authority conferred by the Executive Order of March 3, 1913, creating the Aleutian Islands Reservation, the Secretary of Commerce and the Secretary of Agriculture jointly issued regulations for the administration of the reservation, effective March 15, 1914. The regulations are as follows:

1. In compliance with existing laws and to carry out the objects of the Executive Order establishing the reservation, all matters relating to wild birds and game, and the propagation of reindeer and fur-bearing animals will be under the immediate jurisdiction of the Department of Agriculture; all matters pertaining specifically to the fisheries and all aquatic life, and to the killing of fur-bearing animals, will be under the immediate jurisdiction of the Department of Commerce; and all matters other than those specifically mentioned above will be under the joint jurisdiction of the Departments of Agriculture and Commerce.

2. Persons residing within the limits of the reservation on March 3, 1913, will be permitted to continue to so reside, and to carry on any lawful business not interfering with the purposes of the reservation.

3. Residents of the reservation desiring to engage in commercial fishing, or the hunting trapping, or propagation of fur-bearing animals or game animals, must first secure a permit to do so.

4. Anyone desiring to enter the reservation for the purpose of fishing, hunting, trapping or propagating fur-bearing animals or game animals, or engaging in commercial fishing, salmon canning, salmon salting, or otherwise curing or utilizing fish or other aquatic products, or for the purpose of engaging in any lawful business, must first obtain a permit to do so.

5. Whenever, in the propagation of fur-bearing animals, it shall be found to be necessary to kill such of these animals as interfere with the work of the Department of Agriculture in this behalf, they may be killed under the supervision of said department, and no permit will be required therefor.

6. *Fishery permits.*—Application for permission to engage in fishing or fishery operations should give full information on the following points: Name and permanent address of the person or company desiring the permit; character of business proposed, whether fishing, canning, salting, or otherwise curing fish or other aquatic products; character and extent of proposed plant and its location; method and extent of the fishing proposed, place or places where fishing is to be carried on, and when active operations are to begin.

7. *Trapping and hunting permits.*—Applications for permission to engage in trapping, hunting or propagating fur-bearing animals or game animals should give the name of the person desiring the permit and the island or islands on which it is proposed to operate. At present no permits will be issued for trapping or hunting fur-bearing animals except to natives of the reservation.

8. *Permits to ship live foxes from the reservation.*—For the present no permits will be issued for capture and shipment of live foxes from the reservation, except domestic stock from established fox farms.

9. Permits to enter the reservation for the purpose of engaging in any business will be granted only when the department concerned is convinced that, by so doing, the objects for which the reservation was established will not be endangered thereby.

10. *Collecting permits.*—Permits to enter the reservation for the purpose of collecting birds, mammals, or other natural-history specimens for scientific purposes will be granted only to properly accredited representatives of the United States Government or agents of public museums.

11. *Reindeer and caribou.*—The killing of reindeer and caribou on any of the islands of the reservation is hereby prohibited except under special permit.

MAINE LOBSTER CONFERENCE.

In the lobster-cultural work of the Bureau on the coast of Maine there has grown up a practice which, on economic grounds, can hardly be defended. This has comprised the purchase of egg-bearing lobsters from fishermen and dealers at market prices and the release of the lobsters in the open sea after their eggs had been stripped from them. The limited funds of the Bureau have thus been diverted from the real work of lobster culture and have to a very great extent been wasted, for lobsters whose eggs have been saved may very properly enter into the trade; as a matter of fact, a large part of those released are subsequently caught and resold by the fishermen.

After full consideration it was decided to discontinue this practice and to make arrangements for utilizing the lobsters which had served their purpose in nature. A conference with the State officials having developed the fact that there was no law or regulation which prevented the sale of lobsters whose eggs had been stripped off, it was determined to make an exchange of such lobsters for egg-bearing lobsters of equal value. This means a saving of many thousand dollars annually, and will permit a noteworthy increase in lobster hatching.

The purposes of the Bureau were misunderstood in Maine, and many inquiries, complaints, and criticisms were received. The outcome was a conference held on January 23, 1914, at the office of the Commissioner of Fisheries, for the purpose of announcing the policy of the Bureau in this matter and its general attitude toward the lobster industry, and of making known the views of the State Commissioner of Sea and Shore Fisheries, the lobster fishermen, and the lobster dealers, all of whom were represented at the conference. The Governor of Maine and the entire State delegation in Congress were also present. The new policy of the Bureau was unanimously approved. A formal minute, showing the manner in which collections of egg-bearing lobsters would hereafter be made by the Bureau, was adopted in behalf of the lobster dealers with the approval of the State authorities, as follows: In order to assist in maintaining the lobster supply on the coast of Maine, and to cooperate with the Federal Government and the State of Maine in the work of artificial propagation, the lobster dealers and owners of lobster pounds will hereafter furnish to agents of the Bureau of Fisheries as heretofore any seed lobsters which may come into their possession, weighing the same and computing their value at the current market prices, and taking in exchange therefor lobsters which have been stripped of their eggs by the Bureau of Fisheries, due allowance being made for difference in price.

PUBLICATIONS.

The most important feature in connection with the publications of the Bureau during the past year has been the increased number and growing popularity of the recently instituted "Economic Circulars." These brief papers, sometimes giving advance information on work under way, may often have a complete and definite purpose of their own. Thus, of Economic Circular No. 11, "Canned salmon: Cheaper than meats and why, including fifty tested recipes," 25,000 copies were printed for distribution by the Bureau to encourage the utilization of salmon and an extra edition of 10,000 was printed on private orders. Economic Circular No. 12, "Sea mussels: What they are and how to cook them, including eighteen recipes," was used to similar purpose in a publicity campaign to establish a market for a new sea food.

Reports on special work of the Bureau and technical papers on biological subjects have been published as usual, the former in the regular series of papers associated with the annual report of the Commissioner and the latter as parts of the annual Bulletin of the

Bureau of Fisheries. A complete list of all documents issued during the year is as follows:

Observations on fish scales. By T. D. A. Cockerell. Bulletin, vol. xxxii, 1912, p. 117–174, pl. xxxii–xl, 52 text fig.
Fishery and fur industries of Alaska in 1912. By Barton Warren Evermann. 123 p.
The mussels of the Cumberland River and its tributaries. By Charles B. Wilson and H. Walton Clark. 63 p.
Report of the Commissioner of Fisheries for the fiscal year ended June 30, 1913. 78 p.
Fishes and fishing in Sunapee Lake. By William Converse Kendall. 96 p.
A new method for the determination of the food value of proteins, with application to Cynoscion regalis. By George F. White and Adrian Thomas. Bulletin, vol. xxxii, 1912, p. 175–182, 2 text fig.
Properties of fish and vegetable oil mixtures. By George F. White and Adrian Thomas. Bulletin, vol. xxxii, 1912, p. 183–198, 9 text fig.
The effect of water-gas tar on oysters. By Philip H. Mitchell. Bulletin, vol. xxxii, 1912, p. 199–206.
The oxygen requirements of shellfish. By Philip H. Mitchell. Bulletin, vol. xxxii, 1912, p. 207–222, text fig.
The Anthozoa of the Woods Hole region. By Charles W. Hargitt. Bulletin, vol. xxxii, 1912, p. 223–254, pl. xli–xliv.
The Cephalopoda of the Hawaiian Islands. By S. Stillman Berry. Bulletin, vol. xxxii, 1912, p. 255–362, pl. xlv–lv.
Carcinoma of the thyroid in the salmonoid fishes. By Harvey R. Gaylord and Millard C. Marsh. Bulletin, vol. xxxii, 1912, p. 363–524, pl. lvi–cx, 53 text fig.

ECONOMIC CIRCULARS.

The mussel fisheries of Caddo Lake and the Cypress and Sulphur Rivers of Texas and Louisiana. 10 p.
Opportunity for a new sea scallop fishery off the Middle Atlantic coast. 5 p.
The offshore fishing grounds of North Carolina. 6 p.
Mussel streams of eastern Oklahoma. 4 p.
Mussel resources in Missouri. 6 p.
Canned salmon: Cheaper than meats and why, including fifty tested recipes. 11 p.
Sea mussels: What they are and how to cook them, with eighteen recipes. 5 p., 1 text fig.

APPROPRIATIONS.

The appropriations for the Bureau for the fiscal year 1914 aggregated $1,047,180, as follows:

Salaries	$391, 180
Miscellaneous expenses:	
Administration	10, 000
Propagation of food fishes	335, 000
Inquiry respecting food fishes	40, 000
Statistical inquiry	7, 500
Maintenance of vessels	60, 000
Protecting the sponge fisheries	3, 500
Beam-trawl investigation	5, 000
Alaska fisheries service	75, 000
New distribution cars	30, 000
Steamer *Albatross* repairs	40, 000
Establishment of fish-cultural stations:	
Utah	25, 000
Rhode Island	25, 000

A full report of expenditures authorized by these appropriations will be made to Congress as required by law.

FISHERY MATTERS BEFORE CONGRESS.

In the act making appropriations for the support of the Bureau for the fiscal year 1915, a very important limitation was placed on the lump sum of money provided for the propagation of food fishes. The limiting clause, which will conduce to economy and increased efficiency of the fish-cultural work and will greatly strengthen the position of the Bureau in its cooperative relations with the States, is as follows:

> No part of the foregoing amount shall be expended for hatching or planting fish or eggs in any State in which, in the judgment of the Secretary of Commerce, there are not adequate laws for the protection of the fishes, nor in any State in which the United States Commissioner of Fisheries and his duly authorized agents are not accorded full and free right to conduct fish-cultural operations, and all fishing and other operations necessary therefor, in such manner and at such times as is considered necessary and proper by said Commissioner or his agents.

During the fiscal year 82 bills were introduced in the House of Representatives providing for the establishment of fish-cultural and biological stations and 18 similar bills were presented in the Senate. Of the latter 9 passed that body. In addition, an omnibus bill providing for the establishment of 15 fish-cultural stations in different States and carrying amounts aggregating nearly $800,000 was favorably reported by the Committee on the Merchant Marine and Fisheries and placed on the House calendar.

A bill providing for Federal control over fishes that do not remain within the waters of any State or Territory was introduced in the House, and hearings thereon were held by the Committee on the Merchant Marine and Fisheries. The bill affects primarily the migratory fishes of the coastal, Great Lakes, and interstate waters, and vests the power to regulate their capture in the Department of Commerce. This bill, if passed, will mark a new departure in Federal fishery legislation.

A bill to regulate the taking of sponges in the waters of the Gulf of Mexico and the Straits of Florida outside of State jurisdiction passed the Senate but did not come up in the House during the fiscal year. It, however, passed the House in August, and was signed by the President and became effective August 15, 1914. This law corrects defects in previous legislation and was advocated by the Bureau.

In March, 1914, the Senate passed a bill to give effect to the treaty of April 13, 1908, providing for joint international regulations for the fisheries in the contiguous waters of the United States and Canada. A favorable report was made on the measure by the Committee on Foreign Affairs of the House, but no final action was taken. Inasmuch as Canada, in 1910, adopted the regulations made in accordance with the treaty, the failure of the United States to comply with the treaty stipulations has caused much embarrassment, and there is a possibility that Canada will take steps to abrogate the treaty. Should this be done, certain fisheries that can not get adequate protection except through international agreement will suffer.

A bill authorizing the Secretary of Commerce, through the Coast and Geodetic Survey and the Bureau of Fisheries, to make a survey of oyster beds in the State of Florida, passed the Senate, and an item for this work, under the direction of the Bureau of Fisheries, was incorporated in the sundry civil appropriation act for 1915.

A bill was passed granting the State of California authority to construct a State road through the reservation at the Baird, Cal., fisheries station, and right of way for a boulevard 120 feet wide through the Louisville, Ky., fisheries station was granted by a clause in the sundry civil appropriation act for 1915.

A joint resolution giving authority to take not exceeding 30 specimens of fur seals on the Pribilof Islands for the National Museum passed the Senate and was recommended by the House Committee on the Merchant Marine and Fisheries, but failed of passage in the House.

RECOMMENDATIONS.

The recommendations in the report of the Bureau for the previous fiscal year regarding (1) a lobster-rearing plant for the New England coast, (2) a fishery research laboratory for the Pacific coast, (3) increased men and vessels for the Alaskan service, (4) relief from the incongruous duties imposed by law in connection with the fur-bearing animals of Alaska, (5) the establishment of a fishery experiment station, (6) the creation of the position of fish pathologist, (7) the granting of increased aid to the shellfish industries, and (8) a new office building for the Bureau in Washington, are reaffirmed.

Special emphasis should be laid on the urgent need for a building which will combine adequate office accommodations with laboratories and a national aquarium. The building occupied by the Bureau was built in 1856 for purposes entirely foreign to the uses to which it is being put. The lack of every modern convenience, lack of office and storage space, and lack of laboratory facilities have frequently been dwelt on. The surgeon of the Public-Health Service who inspected the building in June, 1914, in accordance with an Executive Order, reported on the congestion, and criticized the use of lockers and unventilated closets for clothing and cleaning material, and other antiquated, unhealthful conditions which can not be ameliorated in such crowded space. The building is surrounded on two sides by storage sheds whose tin roofs reflect and radiate heat to such a degree that, notwithstanding the constant use of electric fans, the temperature in some rooms is often such that no one should be required to work in them. Several cases of prostration have occurred. These sheds are very unsightly and a blemish to The Mall, but are necessary for storage and shop purposes.

Respectfully,

H. M. Smith,
Commissioner.

To Hon. William C. Redfield,
Secretary of Commerce.

THE DISTRIBUTION OF FISH AND FISH EGGS DURING THE FISCAL YEAR 1914

ROBERT S. JOHNSON
Assistant in Charge of Fish Culture

Appendix I to the Report of the U. S. Commissioner
of Fisheries for 1914

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THE DISTRIBUTION OF FISH AND FISH EGGS DURING THE FISCAL YEAR 1914.

CHARACTER OF THE WORK.

The fish-cultural work of the Bureau of Fisheries may be said to have two general objects—the restoration and maintenance of the commercial fisheries of the country, and the stocking of its interior waters with the more important food and game fishes to which they are adapted. In the prosecution of the former of these objects, which is concerned with the salmons, whitefish, lake trout, pike perch, shad, white perch, yellow perch, cod, lobster, pollock, and other commercial species, the Bureau acts on its own initiative, carefully planning its distributions of young fish with the view of conserving and increasing the importance of existing fisheries, and of establishing a basis for their extension through the systematic annual planting of fish of suitable species in fertile but unproductive fields.

In that part of its work which relates to the stocking of interior lakes and streams the Bureau solicits the participation of the public. It cooperates with individuals or associations who may be interested in deciding as to the waters to be stocked, considers their suggestions as to the species of fish best suited therefor, and relies upon them to see that the fish furnished are properly planted in the waters for which they are assigned.

While this branch of the work is relatively small, constituting only about 5 per cent of the annual output, the benefits accruing therefrom are considered invaluable, not only in the economic sense of increasing the food supply by the utilization of many waters heretofore unproductive, but also because of their educational effect in developing and fostering a sentiment favorable to the protection and growth of the fisheries. The fishes principally produced for such waters are several of the native trouts, the grayling, the black basses, crappies, sunfishes, and catfishes.

Owing to the practicability of hatching the eggs of the trouts by artificial means, the demands for such species can readily be supplied. On the other hand, the resources for the production of the warm-water species, commonly known as "pond fishes," are extremely limited, and it is with the greatest difficulty that the insistent and growing demands for them can be met. These fishes must of necessity be cultivated naturally in open ponds where the eggs and young are subjected to many hazards, chief among them being sudden temperature changes, turbidity of the water after heavy rains, ravages of snakes and other enemies, and depletion of the stock through cannibalism, all of which conditions can be mitigated or controlled only in part. The harvest is therefore uncertain, and the output of one year can not be used as a standard on which to base estimates of succeeding seasons.

For many years the Bureau has been doing a valuable work of conservation by rescuing vast numbers of black bass and other native fishes from the temporary pools and bayous formed by the annual flooding of certain navigable interstate rivers, and at the same time has been able to secure considerable numbers of young pond fishes for general distribution. In the conduct of this work it has been the Bureau's policy to remove fish only from such places as will dry up or freeze solidly before a recurring high-water stage, returning to the main rivers the bulk of the collections and utilizing any surplus to supplement its supplies for shipment to applicants. As in the pond fish-cultural work at its stations, the degree of success attending the seining operations depends largely upon climatic conditions, and occasionally the work proves a total failure because of the inaccessibility of the spawning grounds owing to the extremely high or low water stages prevailing.

METHOD OF DISTRIBUTION.

Almost the entire output of young fish of the commercial species handled by the Bureau is returned to the original sources of supply or liberated in other public waters where conditions are favorable to the establishment of new fisheries. Where eggs or fish for stock purposes are derived from interior waters especial care is taken to return to such waters a sufficient number of young fish of like species to insure the maintenance of the supply. The remainder of the stock available is then allotted on individual applications, bearing the indorsement of a United States Senator or Representative, such applications being submitted on a blank form furnished by the Bureau, which among other things calls for a detailed description of the waters for which fish are desired. In passing upon applications the preference of the applicants as to species assigned is taken into account, but the Bureau reserves the right of final decision of this question, taking into consideration not only the character of the waters, but the welfare of existing local fisheries, and selecting such species of fish as will not be likely to prove injurious to or be injured by those already established.

In general the assignment of nonindigenous fishes is made only with the approval of the fisheries authorities of the States concerned. In this connection it may be stated that the Bureau has recently decided to refuse all requests for predaceous fishes for stocking waters in California, Oregon, Washington, Idaho, Nevada, and the western portions of Montana and Wyoming, which proscribed section embraces the most valuable salmon and trout fisheries of the United States.

The fish are carried to their destinations in railroad cars equipped for the purpose or by messengers who accompany the shipments in baggage cars, and are delivered to the applicant free of charge at the railroad station nearest the point of deposit. The applicant is advised by telegraph when the shipment will arrive, and is expected to make due provision for the care of the fish until planted. Definite instructions in this respect are furnished at the time of shipment.

During the fiscal year ended June 30, 1914, the Bureau received 10,502 applications from individuals and associations, for fish to stock both public and private waters. Requests for blanks upon which to submit applications for fish should be addressed to the Commissioner of Fisheries, Washington, D. C.

It is the practice of the Bureau to fill all applications in the order in which they are received, and to arrange for the delivery of the fish as soon as practicable thereafter.

SIZE OF FISH WHEN DISTRIBUTED.

Fish are distributed at various stages of development, depending upon the species, the numbers available, and the facilities for rearing. Shad, whitefish, lake trout, pike perch, cod, and other species which are hatched in lots of many millions are necessarily planted shortly after hatching. The various trouts, the Atlantic salmon, and the landlocked salmon are reared in such numbers as facilities permit to fingerlings from 1 to 6 inches in length; the remainder are distributed as fry.[a]

The black basses, crappies, and other sunfishes are distributed at various ages—some within three weeks after they are hatched and some when several months old. Near the end of the distribution season the basses have usually attained a length of from 4 to 6 inches and the sunfishes are from 2 to 4 inches long. The bass, catfish, and other species collected from overflowed lands vary from 2 to 6 inches in length when taken and distributed.

Eggs are supplied mainly to State hatcheries, but are occasionally furnished to private applicants having hatching facilities, with the understanding that the young fish resulting therefrom are to be distributed in public waters. The Bureau does not furnish eggs for stocking hatcheries whose output is regularly offered for sale.

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[a] The varying usage in the classification of young fish as to size has caused such confusion and difficulty that the Bureau has adopted uniform definitions, as follows:

Fry=fish up to the time the yolk sac is absorbed and feeding begins.

Advanced fry=fish from the end of the fry period until they have reached a length of 1 inch.

Fingerlings=fish between the length of 1 inch and the yearling stage, the various sizes to be designated as follows: No. 1, a fish 1 inch in length and up to 2 inches; no. 2, a fish 2 inches in length and up to 3 inches; no. 3, a fish 3 inches in length and up to 4 inches, etc.

Yearlings=fish that are 1 year old, but less than 2 years old from the date of hatching; these may be designated no. 1, no. 2, no. 3, etc., after the plan prescribed for fingerlings.

SIZE OF ALLOTMENTS.

It is customary to assign but one species of fish on an application, and only one application for the stocking of a body of water at a given point is considered. The number of fish assigned on an application is based upon the water area described, only a sufficient number being allowed to serve as a brood stock, with the understanding that the waters in which they are to be placed will be properly protected until the fish have had time to mature and establish themselves through natural reproduction. The actual number assigned is also dependent upon the species, the size of the fish, and the number available for distribution. In the case of the various trouts 250 fish 2 inches in length, or 50 fish 6 inches in length, are fully equal to 2,500 fry for stocking purposes. Pike perch, which, owing to their excessive cannibalism, can not be reared beyond the fry stage, may be supplied in lots of half a million, where the same water area would receive only 200 or 300 young bass from 2 to 5 inches long. The larger fish have a much better chance of reaching maturity than have the fry, and therefore their value for stocking purposes is many times greater.

Owing to the Bureau's inability to produce the black basses, crappies, catfishes, and sunfishes in sufficient numbers to meet the demands, the allotments of such species are of necessity limited to the smallest number required to form a brood stock for the water area in question.

SPECIES CULTIVATED.

During the fiscal year 1914 the Bureau handled some 50 species of fish, the fresh-water mussel, and the lobster. Of these the following were produced at its regular propagating stations:

The catfishes (Siluridæ):
    Horned pout, bullhead, yellow cat (*Ameiurus nebulosus*).
    Marbled cat (*Ameiurus nebulosus marmoratus*).
The suckers and buffalo-fishes (Catostomidæ):
    Small-mouth buffalo-fish (*Ictiobus bubalus*).
    Common buffalo-fish (*Ictiobus cyprinella*).
    Black buffalo-fish (*Ictiobus urus*).
    Yellow sucker (*Catostomus commersonii*).
The shads and herrings (Clupeidæ):
    Shad (*Alosa sapidissima*).
    Glut herring, blueback (*Pomolobus æstivalis*).
The salmons, trouts, whitefishes, etc. (Salmonidæ):
    Common whitefish (*Coregonus albus* and *C. clupeaformis*).
    Lake herring, cisco (*Leucichthys artedi*).
    Chinook salmon, king salmon, quinnat salmon (*Oncorhynchus tschawytscha*).
    Silver salmon, coho (*Oncorhynchus kisutch*).

THE SALMONS, TROUTS, WHITEFISHES, ETC.—Continued.
- Blueback salmon, redfish, sockeye (*Oncorhynchus nerka*).
- Humpback salmon (*Oncorhynchus gorbuscha*).
- Dog salmon (*Oncorhynchus keta*).
- Steelhead trout, hardhead (*Salmo gairdneri*).
- Rainbow trout (*Salmo irideus*).
- Atlantic salmon (*Salmo salar*).
- Landlocked salmon (*Salmo sebago*).
- Blackspotted trouts: Yellowstone Lake trout or cut-throat trout (*Salmo lewisi*). Tahoe trout (*Salmo henshawi*).
- Scotch sea trout (*Salmo trutta*). Introduced species.
- Loch Leven trout (*Salmo trutta levenensis*). Introduced species, propagated in limited numbers for observation.
- Lake trout, Mackinaw trout, longe, togue (*Cristivomer namaycush*).
- Brook trout, speckled trout (*Salvelinus fontinalis*).

THE GRAYLINGS (THYMALLIDÆ):
- Montana grayling (*Thymallus montanus*).

THE MACKERELS (SCOMBRIDÆ):
- Common mackerel (*Scomber scombrus*).

THE SMELTS (ARGENTINIDÆ):
- American smelt (*Osmerus mordax*).

THE BASSES, SUNFISHES, AND CRAPPIES (CENTRARCHIDÆ):
- Crappie (*Pomoxis annularis*).
- Strawberry bass, calico bass (*Pomoxis sparoides*).
- Rock bass, red-eye, goggle-eye (*Ambloplites rupestris*).
- Warmouth, goggle-eye (*Chænobryttus gulosus*).
- Small-mouth black bass (*Micropterus dolomieu*).
- Large-mouth black bass (*Micropterus salmoides*).
- Bluegill bream, bluegill sunfish (*Lepomis pallidus*).
- Other sunfishes, chiefly *Eupomotis gibbosus*.

THE PERCHES (PERCIDÆ):
- Pike perch, wall-eyed pike, yellow pike, blue pike (*Stizostedion vitreum*).
- Yellow perch, ring perch (*Perca flavescens*).

THE SEA BASSES (SERRANIDÆ):
- Striped bass, rockfish (*Roccus lineatus*).
- White perch (*Morone americana*).

THE CODS (GADIDÆ):
- Cod (*Gadus callarias*).
- Haddock (*Melanogrammus æglifinus*).
- Pollock (*Pollachius virens*).

THE FLOUNDERS (PLEURONECTIDÆ):
- Winter flounder, American flatfish (*Pseudopleuronectes americanus*).

CRUSTACEANS:
- American lobster (*Homarus americanus*).

The fishes rescued from overflowed lands in the Mississippi Basin and returned to the original streams were as follows:

THE CATFISHES (SILURIDÆ):
- Spotted cat, blue cat, channel cat (*Ictalurus punctatus*). Only limited numbers obtainable.
- Horned pout, bullhead, yellow cat (*Ameiurus nebulosus*).

THE SUCKERS AND BUFFALO-FISHES (CATOSTOMIDÆ):
- Small-mouth buffalo-fish (*Ictiobus bubalus*).
- Common buffalo-fish (*Ictiobus cyprinella*).
- Black buffalo-fish (*Ictiobus urus*).

- THE MINNOWS AND CARPS (CYPRINIDÆ):
  - Carp (*Cyprinus carpio*). Distributed in rare instances on special request and for waters unsuited to other species.
- THE PIKES AND PICKERELS (ESOCIDÆ):
  - Pike (*Esox lucius*). Restored to the streams; not distributed.
  - Pickerel (*Esox reticulatus*). Restored to the streams; not distributed.
- THE BASSES, SUNFISHES, AND CRAPPIES (CENTRARCHIDÆ):
  - Crappie (*Pomoxis annularis*).
  - Rock bass, red-eye, goggle-eye (*Ambloplites rupestris*).
  - Warmouth, goggle-eye (*Chænobryttus gulosus*).
  - Large-mouth black bass (*Micropterus salmoides*).
  - Small-mouth black bass (*Micropterus dolomieu*).
  - Bluegill bream, bluegill sunfish (*Lepomis pallidus*).
  - Other sunfishes, chiefly *Eupomotis gibbosus*.
- THE PERCHES (PERCIDÆ):
  - Yellow perch, ring perch (*Perca flavescens*).
  - White bass (*Roccus chrysops*).

Certain introduced species are propagated to a limited extent, as follows:

- THE MINNOWS AND CARPS (CYPRINIDÆ):
  - Goldfish (*Carassius auratus*). Propagated for ornamental purposes; not distributed.

SUMMARIZED STATEMENT OF DISTRIBUTION.

The following table shows the number of fish and eggs actually distributed during the fiscal year 1914, or, in other words, the output of the hatcheries, with all losses in transportation deducted:

SUMMARY, BY SPECIES, OF THE DISTRIBUTION OF FISH AND FISH EGGS DURING THE FISCAL YEAR 1914.

Species.	Eggs.	Fry.	Fingerlings, yearlings, and adults.	Total.
Catfish			554,310	554,310
Carp			231,146	231,146
Yellow sucker			1,200	1,200
Buffalo-fish		150,000	147,195	297,195
Shad		61,827,660		61,827,660
Herring		184,000		184,000
Whitefish	126,580,000	327,435,000		454,015,000
Lake herring		900,000		900,000
Silver salmon	95,840	24,619,456	27,258	24,742,554
Chinook salmon	26,451,545	48,895,607	5,582,796	80,929,948
Blueback salmon	6,020,000	53,071,574	120,000	59,211,574
Humpback salmon		44,817,644	34,355	44,851,999
Dog salmon		8,672,735		8,672,735
Steelhead trout	579,000	4,022,438	313,620	4,915,058
Rainbow trout	1,091,950	181,890	1,656,229	2,930,069
Atlantic salmon		2,573,295	16,993	2,590,288
Landlocked salmon	276,000	329,736	356,332	962,068
Scotch sea trout			20,396	20,396
Blackspotted trout	3,381,240	967,530	2,442,100	6,790,870
Loch Leven trout			46,500	46,500
Lake trout	11,283,000	33,114,171	2,719,473	47,116,644
Brook trout	2,055,000	4,128,290	5,891,033	12,074,323
Smelt	9,400,000	5,775,000	9,400	15,184,400
Grayling	150,000	343,000		493,000
Crappie			549,920	549,920
Rock bass			78,045	78,045
Warmouth bass			1,085	1,085
Small-mouth black bass		91,000	96,745	187,745

SUMMARY, BY SPECIES, OF THE DISTRIBUTION OF FISH AND FISH EGGS DURING THE FISCAL YEAR 1914—Continued.

Species.	Eggs.	Fry.	Fingerlings, yearlings, and adults.	Total.
Large-mouth black bass			822,650	822,650
Sunfish (bream)			690,757	690,757
Pickerel			3,075	3,075
Pike			2,600	2,600
Pike perch	331,950,000	185,914,000		517,864,000
Yellow perch	9,500,000	179,924,389	12,775	189,437,164
Striped bass		11,689,000		11,689,000
White perch	1,400,000	218,600,000	2,000	220,002,000
White bass			4,450	4,450
Cod		252,951,000		252,951,000
Pollock		561,408,422		561,408,422
Mackerel		2,510,000		2,510,000
Haddock		108,584,000		108,584,000
Flatfish		1,171,321,000		1,171,321,000
Lobster		179,990,000	3,567	179,993,567
Total	530,213,575	3,494,991,837	22,438,005	4,047,643,417

ALLOTMENT OF FISH AND EGGS TO STATE FISH COMMISSIONS FOR THE FISCAL YEAR 1914.

State and species.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
California:			
Brook trout	100,000		
Chinook salmon	25,323,645		
Silver salmon	95,840		
Colorado:			
Blackspotted trout	600,000		
Idaho:			
Blackspotted trout	205,000		
Rainbow trout	150,000		
Indiana:			
Pike perch	7,500,000		
Illinois:			
Pike perch	7,500,000		
Maine:			
Brook trout	100,000		
Lake trout	50,000		
Landlocked salmon	100,000		
Maryland:			
Rainbow trout	30,000		
Massachusetts:			
Black bass			400
Chinook salmon	50,000		
Pike perch	20,225,000		
Yellow perch	8,000,000		
Michigan:			
Grayling	50,000		
Lake trout	3,008,000		
Landlocked salmon	25,000		
Pike perch	15,000,000		
Smelt	5,000,000		
Minnesota:			
Lake trout	250,000		
Landlocked salmon	15,000		
Steelhead trout	50,000		
Missouri:			
Brook trout	50,000		
Rainbow trout	50,000		
Pike perch	10,000,000		
Montana:			
Black bass			66
Blackspotted trout	636,240		
Brook trout	200,000		
Lake trout			18,900
Whitefish	2,000,000		

ALLOTMENT OF FISH AND EGGS TO STATE FISH COMMISSIONS FOR THE FISCAL YEAR 1914—Continued.

State and species.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Nebraska:			
Pike perch	2,000,000		
Rainbow trout	100,000		
Nevada:			
Brook trout	50,000		
Rainbow trout	98,000		
New Hampshire:			
Brook trout	75,000		
Landlocked salmon	30,000		
Rainbow trout	50,000		
Steelhead trout	50,000		
White perch	1,000,000		
New Jersey:			
Crappie			210
Landlocked salmon	10,000		
Pike perch		2,500,000	
Sunfish			500
Yellow perch		6,500,000	
New York:			
Lake trout	100,000		
Steelhead trout	50,000		
North Dakota:			
Pike perch	5,000,000		
Rainbow trout	100,000		
Steelhead trout	100,000		
Ohio:			
Pike perch	261.625,000		
Whitefish	83,320,000		
Oregon:			
Blackspotted trout	200,000		
Blueback salmon	2,000,000		
Brook trout	250,000		
Chinook salmon	1,000,000		
Rainbow trout	200,000		
Pennsylvania:			
Lake trout	100,000		
Whitefish	36,000,000		
Utah:			
Brook trout	175,000		
Lake trout	50,000		
Steelhead trout	50,000		
Vermont:			
Brook trout			7,000
Lake trout	50,000		
Landlocked salmon	20,000		
Spotted catfish			108
Steelhead trout	50,000		
Washington:			
Blueback salmon	50,000		
Brook trout	100,000		
Steelhead trout	20,000		
Wisconsin:			
Lake trout	7,500,000		
Whitefish	5,000,000		
Wyoming:			
Blackspotted trout	800,000		
Brook trout	250,000		
Rainbow trout	192,000		
Steelhead trout	50,000		
Total	514,237,725	9,000,000	27,814

DETAILS OF OUTPUT FOR 1914.

The following table shows the work of the different stations in 1914, the periods of operations, and the eggs and fish furnished by each station for distribution. It will be noted that transfers of fish and eggs from station to station are frequent. Such transfers are made in the interest of economy and convenience where the shipments consist of eggs, and give advantageous distribution centers in the case of young fish.

STATIONS OPERATED AND THE OUTPUT OF EACH FOR THE FISCAL YEAR 1914.

Station and period of operation.	Species.	Output.			Total.
		Eggs.	Fry.	Fingerlings, yearlings, and adults.	
Afognak, Alaska: Entire year	Blueback salmon	3,970,000	7,761,705		11,731,705
	Humpback salmon		12,034,399		12,034,399
	Silver salmon		50,000		50,000
Baird, Cal.: Entire year	Chinook salmon	2,900		3,011,085	3,013,985
Battle Creek, Cal.: Dec.–Apr.	Chinook salmon	9,600,365	4,793,249	838,906	15,232,520
Hornbrook, Cal.: Nov.–May	Chinook salmon	990,480	805,100		1,795,580
	Rainbow trout	14,700	30,300		45,000
	Silver salmon	95,840	2,536,460		2,632,300
Mill Creek, Cal.:[a] Dec.–Jan.	Chinook salmon	14,782,800			14,782,800
Baker Lake, Wash.:[a] Entire year	Blueback salmon	50,000	2,583,469	120,000	2,753,469
	Humpback salmon			4,355	4,355
	Silver salmon		936,152		936,152
Birdsview, Wash.:[a] Entire year	Chinook salmon		54,940		54,940
	Dog salmon		539,400		539,400
	Humpback salmon		6,267,500		6,267,500
	Silver salmon		5,154,412		5,154,412
	Steelhead trout	579,000	752,225		1,331,225
Darrington, Wash.: Entire year	Chinook salmon		3,000		3,000
	Dog salmon		745,410		745,410
	Humpback salmon		565,000		565,000
	Silver salmon		250,390		250,390
Day Creek, Wash.:[a] Entire year	Silver salmon		12,300		12,300
Duckabush, Wash.: Entire year	Chinook salmon		42,000		42,000
	Dog salmon		3,096,000		3,096,000
	Humpback salmon		12,085,000		12,085,000
	Silver salmon		4,840,000		4,840,000
	Steelhead trout		603,000		603,000
Illabott, Wash.:[a] Entire year	Chinook salmon		100,300		100,300
	Dog salmon		18,500		18,500
	Humpback salmon		683,600		683,600
	Silver salmon		33,000		33,000
	Steelhead trout		287,505		287,505
Quilcene, Wash.: Entire year	Dog salmon		4,269,000		4,269,000
	Humpback salmon		125,300		125,300
	Silver salmon		536,800		536,800
	Steelhead trout		37,700		37,700
Sultan, Wash.:[a] Entire year	Chinook salmon		184,300		184,300
	Dog salmon		4,425		4,425
	Humpback salmon		1,387,923		1,387,923
	Silver salmon		1,828,300		1,828,300
	Steelhead trout		112,000		112,000
Battery, Md.: Apr.–May	Herring		184,000		184,000
	Shad		1,839,600		1,839,600
	White perch	1,400,000	218,600,000		220,000,000
	Yellow perch	9,000,000	57,400,000		66,400,000

[a] For convenience in handling, transfers were made as follows:
Mill Creek to Baird, 1,360,000 chinook salmon eggs.
Baker Lake to Birdsview, 737,000 humpback salmon eggs; to Central Station, 20,000 humpback salmon eggs; to Craig Brook, 6,720,000 humpback salmon eggs; to Green Lake, 6,520,000 humpback salmon eggs; to Birdsview, 50,000 blueback salmon eggs.
Birdsview to St. Johnsbury, 100,000 steelhead trout eggs; to Duluth, 50,000 steelhead trout eggs.
Day Creek to Birdsview, 1,688,000 humpback salmon eggs; 23,000 chinook salmon eggs; 1,222,000 silver salmon eggs; 145,400 steelhead trout eggs.
Illabott Creek to Birdsview, 200,000 dog salmon eggs; 300,000 silver salmon eggs.
Sultan to Birdsview, 2,300,000 humpback salmon eggs.

STATIONS OPERATED AND THE OUTPUT OF EACH FOR THE FISCAL YEAR 1914—Con.

Station and period of operation.	Species.	Output.			Total.
		Eggs.	Fry.	Fingerlings, yearlings, and adults.	
Boothbay Harbor, Me.: Entire year	Cod		5,859,000		5,859,000
	Flatfish		556,081,000		556,081,000
	Haddock		894,000		894,000
	Lobster		173,500,000	4,007	173,504,007
	Pollock		19,223,422		19,223,422
Bozeman, Mont.:[a] Entire year	Blackspotted trout		649,600	39,500	689,100
	Brook trout			368,850	368,850
	Grayling	150,000	250,000		400,000
	Lake trout			24,400	24,400
	Rainbow trout	50,000		98,268	148,268
	Steelhead trout			8,335	8,335
Yellowstone, Wyo.:[a] July–Aug	Blackspotted trout	3,381,240	123,300		3,504,540
Bryans Point, Md.:[a] Apr.–May	Shad		27,088,060		27,088,060
	Yellow perch		110,224,389		110,224,389
Cape Vincent, N. Y.: Entire year	Brook trout		899,000		899,000
	Lake herring		900,000		900,000
	Lake trout		3,628,171		3,628,171
	Landlocked salmon		13,750		13,750
	Pike perch		9,700,000		9,700,000
	Rainbow trout		8,460		8,460
	Whitefish		27,000,000		27,000,000
Central Station, Washington, D. C.: Entire year	Black bass			2,250	2,250
	Brook trout		23,790		23,790
	Catfish			800	800
	Crappie			1,015	1,015
	Humpback salmon		11,250		11,250
	Pike perch		6,100,000		6,100,000
	Rainbow trout		26,835		26,835
	Rock bass			2,800	2,800
	Shad		350,000		350,000
	Small-mouth black bass			2,060	2,060
	Smelt			9,400	9,400
	Sunfish			5,700	5,700
	Warmouth bass			1,085	1,085
	Whitefish		485,000		485,000
	White perch			2,000	2,000
	Yellow perch		2,800,000	1,350	2,801,350
Clackamas, Oreg.: Entire year	Brook trout			28,000	28,000
	Chinook salmon	75,000	9,078,055	602,300	9,755,355
	Lake trout			660	660
	Rainbow trout		17,500		17,500
	Silver salmon		636,900		636,900
	Steelhead trout		853,700		853,700
Applegate, Oreg.: Entire year	Chinook salmon		31,439		31,439
	Silver salmon		4,372,410		4,372,410
	Steelhead trout		168,278		168,278
Big White Salmon, Wash.:[a] Nov.–Mar	Chinook salmon		14,407,500	567,948	14,975,448
Illinois River, Oreg.: March	Chinook salmon		659,750		659,750
	Silver salmon		804,755		804,755
Little White Salmon, Wash.:[a] Entire year	Chinook salmon		16,348,400	562,557	16,910,957

[a] For convenience in handling, transfers were made as follows:
Bozeman to Clackamas, 4,000 blackspotted trout fry; to Leadville, 50,000 grayling eggs; to Northville, 50,000 grayling eggs; to Erwin, 10,000 rainbow trout eggs.
Yellowstone to Leadville, 1,700,000 blackspotted trout eggs; to Bozeman, 801,920 blackspotted trout eggs; to Spearfish, 1,003,200 blackspotted trout eggs.
Bryans Point to Central Station, 3,900,000 yellow perch eggs; 511,000 shad eggs.
Big White Salmon to Clackamas, 1,275,000 chinook salmon eggs; to Seufert's Cannery, 4,584,000 chinook salmon eggs.
Little White Salmon to Clackamas, 7,828,000 chinook salmon eggs.

STATIONS OPERATED AND THE OUTPUT OF EACH FOR THE FISCAL YEAR 1914—Con.

Station and period of operation.	Species.	Output.			Total.
		Eggs.	Fry.	Fingerlings, yearlings, and adults.	
Clackamas, Oreg.—Contd.					
Lower Rogue River, Oreg.:[a]					
Entire year	Chinook salmon		120,860		120,860
	Silver salmon		1,499,685		1,499,685
Rogue River, Oreg.:					
Entire year	Blackspotted trout		17,630		17,630
	Chinook salmon	1,000,000	2,266,714		3,266,714
	Silver salmon		1,127,892	27,258	1,155,150
	Steelhead trout		1,208,030		1,208,030
Willamette River, Oreg.:					
July–June	Shad		3,327,000		3,327,000
Cold Springs, Ga.:					
Entire year	Black bass			60,425	60,425
	Catfish			1,716	1,716
	Sunfish			23,665	23,665
Craig Brook, Me.:[a]					
Entire year	Atlantic salmon		328,576	16,993	345,569
	Brook trout			55,590	55,590
	Humpback salmon		2,917,072		2,917,072
	Landlocked salmon			57	57
	Rainbow trout			94	94
	Scotch sea trout			20,396	20,396
Upper Penobscot, Me.:					
Mar.–May	Atlantic salmon		2,244,719		2,244,719
Duluth, Minn.:[a]					
Entire year	Brook trout			326,000	326,000
	Lake trout	775,000	13,660,000	2,565,500	17,000,500
	Landlocked salmon			43,000	43,000
	Rainbow trout			4,000	4,000
	Steelhead trout			48,700	48,700
	Pike perch		2,400,000		2,400,000
	Whitefish		15,750,000		15,750,000
Edenton, N. C.:					
Entire year	Black bass			8,025	8,025
	Shad		29,423,000		29,423,000
	Sunfish			230	230
Weldon, N. C.:					
Apr.–May	Striped bass		11,689,000		11,689,000
Erwin, Tenn.:					
Entire year	Black bass			850	850
	Brook trout			206,300	206,300
	Carp			100	100
	Rainbow trout			457,650	457,650
	Rock bass			23,950	23,950
	Small-mouth black bass.			800	800
	Sunfish			24,518	24,518
	Yellow suckers			1,200	1,200
Gloucester, Mass.:[a]					
Entire year	Cod		64,780,000		64,780,000
	Flatfish		242,010,000		242,010,000
	Haddock		107,690,000		107,690,000
	Lobster		6,490,000		6,490,000
	Pollock		542,185,000		542,185,000
Green Lake, Me.:					
Entire year	Brook trout			433,400	433,400
	Humpback salmon		4,270,600	30,000	4,300,600
	Lake trout			89,153	89,153
	Landlocked salmon			219,931	219,931
	Smelt	9,400,000	5,775,000		15,175,000
Grand Lake Stream, Me.:[a]					
Entire year	Landlocked salmon	276,000	312,486	56,709	645,195

[a] For convenience in handling, transfers were made as follows:

Lower Rogue River to Rogue River, 1,300,000 silver salmon eggs.

Craig Brook to Central Station, 269 fingerling and 14 adult landlocked salmon; to Upper Penobscot Station, 7,427,000 Atlantic salmon eggs.

Duluth to Green Lake, 100,000 lake trout; to St. Johnsbury, 100,000; to Clackamas, 25,000; to Bozeman, 25,000; to Spearfish, 25,000 lake trout eggs.

Gloucester to Boothbay Harbor, 38,921,000 pollock eggs.

Grand Lake Stream to Duluth, 50,000; to Bozeman, 25,000; to Cape Vincent, 15,000; to Nashua, 25,000; to St. Johnsbury, 50,000 landlocked salmon eggs; to Green Lake, 90,000 landlocked salmon fry.

STATIONS OPERATED AND THE OUTPUT OF EACH FOR THE FISCAL YEAR 1914—Con.

Station and period of operation.	Species.	Output.			Total.
		Eggs.	Fry.	Fingerlings, yearlings, and adults.	
Homer, Minn.: Entire year	Black bass			12,456	12,456
	Catfish			10,700	10,700
	Crappie			306,500	306,500
	Pike perch		6,084,000		6,084,000
	Small-mouth black bass.			3,000	3,000
	Sunfish			313,384	313,384
	Yellow perch			4,125	4,125
Leadville, Colo.:[a] Entire year	Blackspotted trout			1,879,500	1,879,500
	Brook trout	1,875,000	120,000	1,934,200	3,929,200
	Grayling		45,000		45,000
	Rainbow trout			267,900	267,900
Mammoth Spring, Ark.:[a] Entire year	Black bass			7,480	7,480
	Rock bass			22,250	22,250
	Small-mouth black bass.			36,389	36,389
Friars Point, Miss.:[a] July–Aug	Black bass			9,550	9,550
	Catfish			2,782	2,782
	Sunfish			8,205	8,205
Manchester, Iowa:[a] Entire year	Brook trout			319,800	319,800
	Rainbow trout	892,000		63,800	955,800
	Pike perch		1,800,000		1,800,000
	Rock bass			300	300
	Small-mouth black bass.			75	75
Bellevue, Iowa:[a] July–Nov	Black bass			66,395	66,395
	Buffalo fish			133,000	133,000
	Carp			222,925	222,925
	Catfish			396,600	396,600
	Crappie			106,140	106,140
	Pickerel			3,075	3,075
	Pike			1,300	1,300
	Sunfish			50,185	50,185
	White bass			4,450	4,450
	Yellow perch			1,430	1,430
North McGregor, Iowa:[a] ept.–Oct	Blackbass			6,475	6,475
	Buffalo fish			14,000	14,000
	Carp			7,000	7,000
	Catfish			50,138	50,138
	Crappie			86,000	86,000
	Pike			1,300	1,300
	Sunfish			154,600	154,600
	Yellow perch			700	700
Nashua, N. H.: Entire year	Brook trout		890,000	9,600	899,600
	Landlocked salmon		4,000	17,110	21,110
	Rainbow trout		41,795		41,795
	Small-mouth black bass.		35,000	300	35,300
	Steelhead trout			89,085	89,085
Neosho, Mo.:[a] Entire year	Black bass			4,200	4,200
	Carp			251	251
	Crappie			7,900	7,900
	Pike perch		3,100,000		3,100,000
	Rainbow trout	75,250		104,415	179,665
	Rock bass			29,340	29,340
	Small-mouth black bass.			27	27
	Sunfish			16,250	16,250

[a] For convenience in handling, transfers were made as follows:

Leadville to Clackamas, 100,000; to Wytheville, 150,000; to Bozeman, 500,000 brook trout eggs.

Mammoth Spring to Neosho, 1,000 small-mouth bass; to Quincy, 6,620 small-mouth bass; to Tupelo, 10,000 rock bass; to Quincy, 5,400 rock bass.

Friars Point to Mammoth Spring, 2,690 sunfish, 387 catfish.

Manchester to Duluth, 45,000; to Northville, 61,000; to Central Station, 12,250 rainbow trout eggs; to Neosho, 3,000 brook trout fingerlings.

Bellevue to St. Johnsbury, 200 catfish; to Nashua, 300 catfish; to Quincy, 450 white bass and 1,000 carp.

North McGregor to St. Johnsbury, 138 catfish and 500 black bass; to Nashua, 300 sunfish.

Neosho to Quincy, 27,900 rock bass, 9,500 sunfish, 86 carp; to Leadville, 200 black bass, 219,000 rainbow trout eggs, 18,500 rainbow trout fingerlings; to Manchester, 3,000 brook trout fingerlings.

STATIONS OPERATED AND THE OUTPUT OF EACH FOR THE FISCAL YEAR 1914—Con.

Station and period of operation.	Species.	Output.			Total.
		Eggs.	Fry.	Fingerlings, yearlings, and adults.	
Northville, Mich.:[a] Entire year	Brook trout		706,000	3,000	709,000
	Grayling		48,000		48,000
	Lake trout	10,508,000			10,508,000
	Rainbow trout		57,000	3,000	60,000
	Small-mouth black bass.		3,000	52,800	55,800
	Sunfish			7,100	7,100
Charlevoix, Mich.: Feb.-May	Lake trout		11,500,000		11,500,000
Detroit, Mich.:[a] Apr.-May	Pike perch	30,000,000	25,530,000		55,530,000
	Whitefish	5,100,000	96,000,000		101,100,000
Sault Ste Marie, Mich.: Apr.-May	Lake trout		3,500,000		3,500,000
	Whitefish		25,000,000		25,000,000
Put-in Bay, Ohio:[a] Entire year	Lake trout		861,000		861,000
	Pike perch	281,725,000	69,600,000		351,325,000
	Whitefish	121,480,000	163,200,000		284,680,000
Quincy, Ill.:[a] Entire year	Black bass			151,573	151,573
	Buffalo fish		150,000	220	150,220
	Carp			899	899
	Catfish			93,934	93,934
	Crappie			44,313	44,313
	Pike perch		2,200,000		2,200,000
	Sunfish			40,015	40,015
	Yellow perch			6,550	6,550
St. Johnsbury, Vt.:[a] Entire year	Brook trout	180,000	978,000	334,988	1,492,988
	Lake trout		16,000	21,000	37,000
	Landlocked salmon			3,400	3,400
	Small-mouth black bass.		33,000	3,150	36,150
	Steelhead trout			40,000	40,000
Holden, Vt.: Entire year	Brook trout		530,000	13,330	543,330
	Lake trout			15,000	15,000
	Landlocked salmon			18,125	18,125
	Steelhead trout			40,860	40,860
Swanton, Vt.: Apr.-May	Pike perch	20,225,000	58,100,000		78,325,000
	Yellow perch	500,000	9,500,000		10,000,000
San Marcos, Tex.: Entire year	Black bass			470,297	470,297
	Crappie			150	150
	Rock bass			2,100	2,100
	Sunfish			3,930	3,930
Spearfish, S. Dak.: Entire year	Blackspotted trout		210,000	548,100	758,100
	Brook trout			848,375	848,375
	Lake trout			20,010	20,010
	Loch Leven trout			46,500	46,500
	Rainbow trout			94,700	94,700
	Steelhead trout			94,640	94,640
Tupelo, Miss.: Entire year	Black bass			17,730	17,730
	Crappie			600	600
	Sunfish			46,950	46,950
Rosedale, Miss.:[a] Aug	Catfish			440	440

[a] For convenience in handling, transfers were made as follows:

Northville to Duluth, 3,684,000; to Cape Vincent, 4,000,000; to Put in Bay, 1,000,000 lake trout eggs; to Charlevoix, 11,500,000 lake trout eggs.

Detroit to Central Station, 500,000 whitefish eggs; to "Soo" Station, 25,000,000 whitefish eggs; to Duluth, 20,000,000 pike perch.

Put-in Bay to Homer, 7,000,000; to Manchester, 4,000,000; to Wytheville, 2,000,000; to Neosho, 4,000,000; to Cape Vincent, 10,000,000; to Quincy, 3,000,000; to Central Station, 7,000,000 pike perch eggs.

Quincy to Leadville, 375 black bass; to Cold Springs, 211 yellow perch; to Mammoth Spring, 2,400 crappie, 1,650 catfish; to Homer, 350 crappie, 149 black bass.

St. Johnsbury to Holden, 402,190 brook trout eggs; to Central Station, 25,000 brook trout eggs; to Nashua, 59,138 brook trout fry.

Rosedale to Tupelo, 1,015 black bass, 800 catfish.

STATIONS OPERATED AND THE OUTPUT OF EACH FOR THE FISCAL YEAR 1914—Con.

Station and period of operation.	Species.	Output.			Total.
		Eggs.	Fry.	Fingerlings, yearlings, and adults.	
White Sulphur Springs, W. Va.:					
Entire year	Black bass			4,075	4,075
	Brook trout			904,105	904,105
	Rainbow trout			75,710	75,710
	Small-mouth black bass.		20,000		20,000
Woods Hole, Mass.:					
Entire year	Cod		182,312,000		182,312,000
	Flatfish		373,230,000		373,230,000
	Mackerel		2,510,000		2,510,000
Wytheville, Va.: [a]					
Entire year	Black bass			21,775	21,775
	Brook trout			114,600	114,600
	Pike perch		1,800,000		1,800,000
	Rainbow trout	60,000		517,400	577,400
	Rock bass			1,875	1,875
Yes Bay, Alaska:					
Entire year	Blueback salmon	2,000,000	42,726,400		44,726,400
	Humpback salmon		4,500,000		4,500,000
Total		530,213,575	3,495,824,837	22,567,747	4,048,606,159

[a] For convenience in handling, transfers were made as follows:
Wytheville to Quincy, 2,165 rock bass; to White Sulphur Springs, 35,250 rainbow trout fingerlings; to Erwin, 508,600; to Central Station, 25,000; to Leadville, 531,000; to Nashua, 110,000; to Cape Vincent, 25,000 rainbow trout eggs.

The eggs hatched at the main stations listed in the foregoing table are in many cases obtained from auxiliary sources, usually temporary stations occupied during the season only, or, in some instances, mere camps which are shifted from year to year. In the Great Lakes and off the New England coast collections are made by the Bureau's vessels or boats in favorable localities. The following temporary stations and collecting points furnished eggs of the given species for the main hatcheries during 1914:

LIST OF EGG-COLLECTING STATIONS, 1914.

Station.	Period of operation.	Species handled.
Alaska:		
Eagle Lake	May 30–Oct. 27	Blueback salmon.
Ketchikan Creek	September	Humpback salmon.
Uganak Lake	June 11–Oct. 26	Blueback salmon.
Colorado:		
Antero Reservoir	May 7–May 16	Rainbow trout.
Cheesman Lake	Apr. 7–May 15	Do.
Edith Lake	Oct. 15–Nov. 15	Brook trout.
Eldora Lake	do	Do.
Engelbrecht Lake	Oct. 9–Nov. 14	Do.
Musgroves Lake	Oct. 16–Dec. 1	Do.
Seven Lakes	July 1–July 11 June 9–June 30	Blackspotted and rainbow trout.
Smiths Ponds	Oct. 25–Nov. 28	Brook trout.
Stotts Ponds	Oct. 5–Oct. 21	Do.
Turquoise Lake	Oct. 14–Nov. 22	Do.
Uneva Lake	Oct. 27–Nov. 12	Do.
Wellington Lake	Oct. 16–Nov. 25	Do.
Connecticut:		
Noank	Mar. 20–Apr. 4	Flatfish.
Maine:		
Portland	July–September	Lobster.
Massachusetts:		
Boston	Nov. 1–Dec. 13	Do.
Rockport	May 1–July 15	Do.
Waquoit	Jan. 26–Apr. 8	Flatfish.

LIST OF EGG-COLLECTING STATIONS, 1914—Continued.

Station.	Period of operation.	Species handled.
Michigan:		
Au Gres	Nov. 16–Nov. 30	Whitefish.
Au Sable	Nov. 10–Nov. 25	Lake trout.
Bay City	Apr. 11–Apr. 28	Pike perch.
Belle Isle	Oct. 24–Dec. 16	Whitefish.
Charity Island	Oct. 16–Nov. 15	Do.
Detour	Oct. 20–Nov. 14	Lake trout.
Fairport	Oct. 30–Nov. 21	Do.
Frankfort	Nov. 3–Nov. 25	Do.
Grassy Island	Oct. 13–Dec. 3	Whitefish.
Isle Royale	Sept. 21–Nov. 12	Lake trout and whitefish.
Keweenaw Point	Oct. 5–Nov. 2	Lake trout.
Manistique	Oct. 30–Nov. 22 Nov. 28–Dec. 9	Lake trout and whitefish.
Marquette	Oct. 13–Nov. 12	Lake trout.
Monroe	Oct. 30–Dec. 1	Whitefish.
Munising	Oct. 13–Nov. 12	Lake trout.
Naubinway	Nov. 22–Nov. 27	Whitefish.
Ontonagon	Oct. 22–Nov. 13	Lake trout.
St. James	Oct. 29–Nov. 29 Dec. 1–Dec. 16	Lake trout and whitefish.
St. Joseph	Oct. 30–Nov. 28	Lake trout.
Minnesota:		
Grand Marais	Oct. 10–Dec. 2	Do.
Montana:		
O'Dell Creek	Apr. 7–May 15	Grayling.
South Meadow Creek	Mar. 9–May 6	Rainbow trout.
New York:		
Three Mile Bay	Nov. 15–Nov. 30	Lake herring.
Ohio:		
Kellys Island	Nov. 11–Dec. 8	Whitefish.
Middle Bass	Nov. 12–Nov. 30 Apr. 12–Apr. 30	Whitefish and pike perch.
North Bass	Nov. 6–Dec. 6 Apr. 12–Apr. 28	Pike perch.
Port Clinton	Nov. 3–Dec. 4 Apr. 3–May 2	Whitefish and pike perch.
Toledo	Nov. 6–Dec. 4 Apr. 1–May 7	Do.
Oregon:		
Eagle Creek	Sept. 1–Oct. 31	Chinook salmon.
Eagle and Tanner Creeks	Apr. 1–June 20	Steelhead trout.
Rhode Island:		
Wickford	Mar. 9–Apr. 15	Flatfish.
South Dakota:		
Sand Creek	Oct. 20–Jan. 15	Brook trout.
Schmidts Lakes	Oct. 20–Dec. 20	Do.
Vermont:		
Averill Lakes	Sept. 16–Jan. 9	Landlocked salmon.
Darling Pond	July 28–Nov. 28	Brook trout.
Lake Mitchell	Oct. 1–Dec. 19	Do.
Wyoming:		
Clear Creek	July 1–July 23 June 15–June 30	Blackspotted trout.
Columbine Creek	July 1–July 19 June 18–June 30	Do.
Cub Creek	July 1–July 23 June 16–June 30	Do.
Lake Camp	May 30–June 30	Do.
Pelican Creek	June 10–June 30	Do.
Thumb Camp	June 1–June 21	Do.

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1914.

CATFISH.

Disposition.	Fingerlings, yearlings, and adults.	Disposition.	Fingerlings, yearlings, and adults.
Alabama:		Alabama—Continued.	
Andalusia, Radford's pond	100	Cullman, Besch's pond	200
Ariton, Patterson's pond	100	Erin, Lackey's pond	100
Clayton, Richards's mill pond	200	Geneva, Lawhon's pond	100
Comer, Pruett Pond	200	Hanceville, Ashwander's pond	200

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

CATFISH—Continued.

Disposition.	Fingerlings, yearlings, and adults.
Alabama—Continued.	
Inverness, Pickett's pond	100
Seale, Benton Pond	200
West Point, Gum Pond	400
Arizona:	
Flagstaff, Babbit's lake	400
Big Fill Pond	200
Cedar Lake	200
Merino's pond	100
Moritz Lake	200
Mormon Lake	300
Soldier Lake	100
Kirkland, Genung's pond	100
Arkansas:	
Gravette, Dow's pond	166
Hiwasse, Spout Springs Pond	150
Magnolia, McWilliams's pond	100
Paris, Rieder's pond	166
Colorado:	
Arlington, Best Reservoir	200
Durango, Fairfield Pond	200
Falcon, Falling Waters Lake	100
Connecticut:	
Winsted, Moorville Pond	200
Florida:	
Como, Lake Como	100
Georgia:	
Columbus, Ram Pond	100
Covington, Freestone Pond	81
Yellow River	243
Crawfordville, Little River	120
Ogeechee River	120
Durand, Tignor's pond	200
Lagrange, Callaway's pond	150
Lithonia, Honey Creek Pond	81
Norwood, Ray's pond	120
Swain's pond	120
Warrenton, Bear's pond	100
Lowe's pond	100
White Plains, Grimes's pond	81
Illinois:	
Alpha, Crescent Lake	600
Benton, Doty's pond	300
Spring Pond	300
Carbondale, Thompson's lake	300
Effingham, Van Camp Pond	200
Galesburg, Soangetaha Club Pond	400
Meredosia, Meredosia Bay	140
Mississippi River	26,082
Sandwich, Fox River	154
Indiana:	
Angola, Bass Lake	640
Fox Lake	320
Jimerson Lake	320
Lake James	320
Marsh Lake	320
Otter Lake	320
Pigeon Lake	320
Silver Lake	320
Snow Lake	320
Chili, Eel River	400
Indianapolis, Buck Creek	400
Eagle Creek	400
Lagrange, Pigeon River Pond	400
Mount Vernon, Cedar Lake	100
Orland, Lime Lake	400
Mud Lake	400
Williamsburg, Cates's pond	200
Iowa:	
Bellevue, Mississippi River	390,000
Dyersville, Maquoketa River, North Fork	1,500
Manchester, Maquoketa River	4,500
North McGregor, Mississippi River	50,000
Kansas:	
Cheney, Walter's pond	100
Codell, Stockwood Creek	100
Edmond, Clear Lake	100
Kansas—Continued.	
Faulkner, Sunnyslope Pond	100
Frontenac, Anderson's pond	100
Dobson's pond	100
Fishing Club ponds	700
Haderlein's pond	100
Hays, Cottonwood Pond	100
Jetmore, Pawnee Creek	100
Logan, Boethine's pond	100
Luray, Langley's pond	100
Winona, Felts's pond	100
Jackson's pond	100
Kentucky:	
Fidelo, Garrott's pond	100
Hodgenville, Cromwell's pond	100
Green River, South Fork	200
Nolynn Creek	200
Nolynn Creek, North Fork	300
Thomas's pond	100
McBrayer, Salt River	200
New Stead, Little River	300
Pembroke, Brewer's pond	300
Slaughterville, Railroad Lake	400
Vine Grove, County Pond	200
Maryland:	
Antietam, Potomac River	800
Stemmers Run, Lily Pond	200
Massachusetts:	
Fitchburg, Watatic Pond	200
Lee, Stockbridge Lake	200
Springfield, Elm Pond	100
Michigan:	
Wetmore, Grimes Lake	150
Hartney Lake	150
Mississippi:	
Blue Mountain, Rutherford's pond	55
Mantee, Mantee Lake	55
New Houlka, Schooner Creek	55
Schooner Lake	55
Thomas's pond	55
Pontotoc, Ridgeway Lake	55
Ripley, Booker's pond	55
Union, Walters's pond	55
Missouri:	
Billings, Stock Pond	100
Dixon, Gasconade River	400
Doe Run, Rose Hill Pond	200
Festus, Byrd's pond	100
Mansfield, Scott's pond	100
Mount Leonard, Island Lake	200
Rutledge, Adams's pond	100
Seligman, Roller's pond	100
Montana:	
Townsend, Maxwell Creek	400
New Hampshire:	
Concord, Contoocook River	300
New Jersey:	
Westfield, Jackman's pond	500
New Mexico:	
Algodones, Rolando's pond	100
Chamita, Rio Grande	200
Colmor, Ocate River	300
Magdalena, Datil Pond	100
Cox's pond	200
Servilleta, Rio Grande	200
Socorro, Evergreen Ranch Pond	100
New York:	
Addison, Canisteo River	250
Eden Center, Maltbie's pond	100
Newburg, Burkett's pond	100
North Carolina:	
Coats, Branch Pond	150
High Point, Pierce's pond	100
Matthews, Bost's pond	150
Pine Hall, Dan River	300
Reidsville, Griffin's millpond	200

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

CATFISH—Continued.

Disposition.	Fingerlings, yearlings, and adults.
North Dakota:	
Bottineau, Lake McArthur	200
Lake Metegoshe	800
Larson Lake	200
Devils Lake, Devils Lake	1,600
Ohio:	
Belle Valley, Davis's pond	200
Bradford, Greenville Creek	300
Columbus, Little Darby Creek	300
Mount Healthy, Clover Nook Pond	100
Washington Court House, Paint Creek	200
Rattlesnake Creek	400
Oklahoma:	
Cushing, Dunkin's pond	225
Guymon, Hover's pond	100
Childers's pond	100
Okmulgee, Crume's lake	225
Stillwater, Davis's pond	250
Texline, Twin Mills Pond	100
Thackerville, Fernbank Pond	100
Wardville, Three Bars Ranch Pond	100
Oregon:	
Corvallis, Berthold's lake	600
Sheridan, Graves's lake	300
Yamhill River	300
Pennsylvania:	
Ashland, Ramers Run	200
Bloomsburg, Fishing Creek	200
Cherry Tree, Kneedlers Hole Pond	100
Claysburg, Beaverdam Creek	100
Du Bois, Hillcrest Pond	400
Elizabethville, Ice Dam Creek	75
Factoryville, Lake Kewana	200
Mathewson Pond	300
Good Spring, Herb's pond	75
Hosensack, Indian Creek	300
Indiana, Laurel Run	400
Indian Creek, Water Company Lake	400
Lancaster, Conestoga River	500
Marietta, Clarks Pond	100
Minersville, Pine Hill Pond	200
Rohrsville Pond	100
Pequea, Susquehanna River	400
Philadelphia, Park Aquarium	18
Philipsburg, Batchelor Pond	100
Frog Hollow Pond	100
Lake Lochmond	200
Mares Pond	200
Runks Pond	100
Steinens Pond	200
Pine Grove, Swatara Creek	300
Pottsville, Naders Pond	100
Schuylkill Haven Pond	100
Tumbling Run	100
Rauschs, Koenigs Creek	200
Rauschs Dam	200
Reading, Tulpehocken Creek	75
Rowland, Lake Teedyuscung	100
Little Tink Pond	200
Wescolang Lake	100
Russell, Hall's pond	400
Scranton, Moosic Lake	500
Stillwater, Kelchners Run	200
Susquehanna, Susquehanna River	250
Tarr, Smiths Orchard Pond	400
West Hawley, Long Pond Lake	400
Williamsburg, Crooked Run	100
Flowing Spring Pond	400
Three Mile Run	400
Winburne, Ericson's pond	100
Winfield, Benfers Run	75
South Carolina:	
Anderson, Welch's pond	400
Belton, Lewis's pond	400
Enoree, Enoree River	400
South Carolina—Continued.	
Fort Lawn, Catawba River	100
Glendale, Glendale Pond	200
Gramling, Holston Creek Pond	400
Honea Path, Broadmouth Creek	200
Laurens, Holmes's pond	400
Macedon, Taylor's pond	800
Monetta, Bodie's pond	400
Neeses, Boltin Pond	400
Pomaria, Enterprise Pond	800
Ridge Spring, Lott's pond	400
Sandy River, Wilkes's pond	400
Sumter, Cain's mill pond	600
Troy,Cuffy Town Creek	200
Long Cane Creek	400
McBride's pond	200
Wagener, Gunter's pond	400
South Dakota:	
Harrold, Hereford Pond	200
Miller, Struif's lake	200
Murdo, Murdo Pond	200
Newell, Berg's pond	200
Schmele's pond	200
Watertown, Lake Kampeska	750
Woonsocket, Schroeder's lake	200
Tennessee:	
Clarksville, Red River	150
Texas:	
Amarillo, Palo Duro Creek	600
Terra Blanca Creek	300
Aspermont, Riddel's pond	300
Athens, Deen's lake	300
Bluff Dale, Dennis's pond	150
Brady, Rice's pond	300
Campbell, Winstead's pond	150
Canyon City, Rogers's pond	150
Celina, English's pond	300
Colorado, Coleman's pond	150
Commerce, Dalby's pond	150
Hamilton's pond	150
Corsicana, Waterworks Lake	450
Crowell, Beaver Lake	300
Crowell Pond	300
Rasor's pond	300
Donie, Mills's lake	150
Elgin, Johnson's pond	150
Encinal, Achille's pond	150
Enloe, Young's pond	150
Farmersville, Welch's pond	150
Fluvanna, Bad Creek	150
Giddings, Milburn Pond	150
Glazier, Gilhula Creek	300
Goodnight, McCullem Creek Pond	450
Grandview, Sullins's pond	150
Hutto, Cat Lake	150
Kent, Tatum's pond	300
Kirkland, Loar's pond	150
Leesburg, Florence's pond	150
Longview, McQuenn's lake	600
Lott, Looka's pond	150
Lovelady, Satterwhite's pond	150
Lytle, Post Oak Pond	150
Mabank, Jacobs's pond	300
Marfa, Barker's pond	150
Musgrave's pond	150
Tolbert's pond	150
Marshall, Rhoda Jane Lake	750
Maryneal, Boatwright's pond	150
Memphis, Bryant's pond	300
Midland, Ramsey's pond	1,350
Milford, I. & G. N. Lake	150
O'Brien, Hunter's pond	300
Pampa, Campbellite Pond	150
Pleasanton, McCaleb's pond	150
Point, Shepherd's pond	150
Williams's pond	150

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

CATFISH—Continued.

Disposition.	Finger-lings, yearlings, and adults.
Texas—Continued.	
Post City, Two Draw Pond	300
Randolph, Randolph Lake	300
Wright's pond	150
Sagerton, Sagerton Gin Co. Pond	300
Stratford, Crystal Pond	150
Everglade Pond	150
Sulphur Springs, Eberts Lake	300
Talpa, Green's lake	150
Tascosa, Rica Lake	300
Teague, Cedar Lake	300
Texline, Shookum Pond	150
Tioga, Swimming Pond	300
Tulia, Boren's pond	300
Van Horn, Durill's pond	150
Vernon, Staleup's pond	150
Vernon Club Lake	750
Wildcat Lake	300
Vermont:	
West Danville, Joes Pond	138
Lake St. Joseph	200
Virginia:	
Bedford, Ballard's pond	200
Castlewood, Old Court House Pond	100
Covington, Upper Jackson River	200
Cumberland, Roseland Pond	100
Elkton, Willowbank Pond	100
Ellerson, Bates's pond	100
Faber, Faber Pond	100
Frederick Hall, Duerson's pond	100
Front Royal, Baldwin's pond	200
Lynchburg, Maple Shade Pond	100
Virginia—Continued.	
Montpelier, Brooking's pond	100
Natural Bridge, Hill's pond	100
Orange, Church Run	200
Marshall's pond	200
Palmyra, Taylor's pond	100
Richmond, Ward's pond	200
Shipman, Johnson's pond	100
Washington:	
Bellingham, Samish Lake	200
Silver Lake	200
Squalicum Lake	200
Whatcom Lake	200
Dupont, Arper's lake	200
Ephrata, Moses Lake	200
Northport, Deep Creek Lake	200
Pefoone Lake	200
Republic, Copper Lake	200
Wisconsin:	
Hawkins, Shamrock Lake	1,500
La Crosse, Mississippi River	4,900
Wyoming:	
Gillette, Norfolk's pond	400
Lander, Popo Agie River	500
New Castle, Y. T. Reservoir	200
Opal, Smith Lake	100
Powell, Gravel Pond	45
Ralston, Ralston Lake	45
Sheridan, Ranch Pond	200
Upton, Black Thunder Creek	200
Total [a]	554,310

[a] Lost in transit, 2,800.

CARP.

Alabama:	
Cullman, Vandiver's pond	8
Illinois:	
Meredosia, Meredosia Bay	90
Mississippi River	435
Shipman, Olmstead's pond	60
Iowa:	
Bellevue, Mississippi River	222,000
North McGregor, Mississippi River	7,000
Massachusetts:	
New Bedford, Paskamansett River	50
Montana:	
Valier, Lake Avelyn	30
New York:	
Bay Shore, Big Oak Pond	50
Ohio:	
New Carlisle, Muddy Bank Pond	30
Oklahoma:	
Coleman, Coleman Park Pond	23
Hooker, Hertzog's Pond	25
McComb, Pittman's pond	73
Morrison, Turner's pond	23
Soper, Powers's pond	23
Wynnewood, Gardner's pond	23
South Carolina:	
Manning, Thames's pond	18
Simpsonville, Rocky Creek Pond	60
White Rock, Folk's pond	75
South Dakota:	
Conata, Forsch's pond	17
Presho, Gooseneck Pond	17
Tennessee:	
Bethel, Fair Grounds Pond	35
Moscow, Howell's pond	35
Texas:	
Brady, Walker's pond	125
Fluvanna, Bad Creek	250
Marathon, Bennett's pond	125
Paige, Ludwig's pond	100
Mattiza's pond	200
Plano, Webb's pond	125
Virginia:	
Granite, Pond "B"	9
Remington, Lake's pond	12
Total [a]	231,146

[a] Lost in transit, 29.

YELLOW SUCKER.

Virginia:	
Mount Crawford, North River	1,200

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

BUFFALO-FISH.

Disposition.	Fry.	Fingerlings, yearlings, and adults.
Illinois:		
Meredosia, Meredosia Bay	150,000	
Mississippi River		75
Iowa:		
Bellevue, Mississippi River		133,000
North McGregor, Mississippi River		14,000
Pennsylvania:		
Altoona, Juniata River		75
Mance, Berkeley's pond		45
Total [a]	150,000	147,195

[a] Lost in transit, 25 fingerlings.

SHAD.

Disposition.	Fry.	Disposition.	Fry.
District of Columbia:		North Carolina:	
Highway Bridge, Potomac River	250,000	Edenton, Albemarle Sound	27,423,000
Georgia:		Oregon:	
Augusta, Savannah River	1,000,000	Oregon City, Willamette River	2,527,000
Doctortown, Altamaha River	850,000	Virginia:	
Maryland:		Dogue Creek, Potomac River	4,287,200
Battery Haul, Chesapeake Bay	130,000	Mount Vernon, Potomac River	3,769,240
Broad Creek, Potomac River	727,720	Occoquan, Potomac River	7,500,340
Chapmans Point, Potomac River	412,160	Pohick Creek, Potomac River	947,600
Laurel, Patuxent River	100,000	Washington:	
Piscataway Creek, Potomac River	4,170,360	Silvana, Stilaquamish River	750,000
Pomonkey Creek, Potomac River	2,683,640		
Swan Creek, Potomac River	2,589,800	Total [a]	61,827,660
Western Flats, Chesapeake Bay	1,229,600		
Massachusetts:			
Holyoke, Connecticut River	480,000		

[a] Lost in transit, 200,000 fry.

HERRING.

Maryland:			
Eastern Flats, Chesapeake Bay	184,000		

WHITEFISH.

Disposition.	Eggs.	Fry.	Disposition.	Eggs.	Fry.
Michigan:			Michigan—Continued.		
Belle Isle Park, Detroit River		63,050,000	Naubinway, Lake Michigan		3,000,000
Lake St. Clair		9,300,000	New Richmond, Lake Michigan		1,000,000
Caseville, Saginaw Bay		3,000,000	St. Ignace, Straits of Mackinac		1,500,000
Detour, Lake Huron		6,000,000	Whitefish Bay, Lake Superior		10,500,000
East Point, Detroit River		5,000,000	Williams, Fish Lake		400,000
Elk Rapids, Elk Lake		504,000	Wolf Lake		300,000
Escanaba, Lake Michigan		2,000,000	Wrights Island, Lake Superior		1,800,000
Fort Wayne, Detroit River		12,000,000	Minnesota:		
Grace Harbor, Lake Superior		2,500,000	Blundette, Lake of the Woods		450,000
Manistee, Lake Michigan		1,500,000	Duluth, Lake Superior		50,000
Manistique, Lake Michigan		2,000,000	Grand Marais, Lake Superior		1,800,000
Marquette, Lake Superior		3,750,000	Susie Island, Lake Superior		1,800,000

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

WHITEFISH—Continued.

Disposition.	Eggs.	Fry.
Montana:		
Somers, State fish commission	2,000,000	....
New York:		
Battery Park, New York Aquarium	100,000	....
Calf Island, Lake Ontario	....	2,500,000
Fox Island, Lake Ontario	....	8,000,000
Fuller Bay, Lake Ontario	....	3,000,000
Grenadier Island, Lake Ontario	....	10,000,000
Tibbitts Point, Lake Ontario	....	1,000,000
Wilson Bay, Lake Ontario	....	2,500,000
Ohio:		
Catawba Island, Lake Erie	....	20,000,000
Cedar Point, Lake Erie	....	8,000,000
Isle St. George, Lake Erie	....	20,000,000
Kellys Island, Lake Erie	....	40,000,000
Ohio—Continued.		
Locust Point, Lake Erie	....	10,000,000
Marblehead, Lake Erie	....	10,000,000
Middle Bass Island, Lake Erie	....	20,000,000
Port Clinton, Lake Erie	....	5,200,000
Put-in-Bay, Lake Erie	....	20,000,000
State fish commission	83,320,000	....
Toledo, Lake Erie	....	10,000,000
Pennsylvania:		
Erie, Lake Erie	....	485,000
State fish commission	36,000,000	....
Fairmont Park, Park Aquarium	160,000	....
Wisconsin:		
Cornucopia, Lake Superior	....	3,600,000
Sheboygan, State fish commission	5,000,000	....
Total	126,580,000	327,435,000

LAKE HERRING (CISCO).

Disposition.	Fry.
New York:	
Fox Island, Lake Ontario	225,000
Grenadier Island, Lake Ontario	450,000
Wilson Bay, Lake Ontario	225,000
Total	900,000

SILVER SALMON.

Disposition.	Eggs.	Fry.	Fingerlings.
Alaska:			
Afognak, Letnik Lake	....	50,000	....
California:			
Klamathon, Klamath River	....	2,536,460	....
Sisson, State fish commission	95,840	....	....
Oregon:			
Estacada, Upper Clackamas River	....	636,900	....
Grants Pass, Applegate Creek	....	2,528,890	....
Jones Creek	....	630,000	....
Rogue River	....	869,685	....
Selma, Illinois River	....	552,755	....
Rancherie Creek	....	252,000	....
Trail, Rogue River	....	1,127,892	27,258
Wilderville, Applegate Creek	....	1,843,520	....
Washington:			
Baker Lake, Baker Lake	....	936,152	....
Birdsview, Grandy Creek	....	4,865,412	....
Phinney Creek	....	250,000	....
Skagit River	....	39,000	....
Darrington, Skagit River	....	250,390	....
Day Creek, Day Creek	....	12,300	....
Duckabush, Duckabush River	....	4,840,000	....
Illabott, Illabott Creek	....	33,000	....
Quilcene, Big Quilcene River	....	425,000	....
Little Quilcene River	....	111,800	....
Sultan, Elwell Creek	....	1,828,300	....
Total	95,840	24,619,456	27,258

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

CHINOOK SALMON.

Disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
California:			
Baird, McCloud River			3,011,085
Battle Creek, Battle Creek		4,793,249	838,906
Klamathon, Klamath River		865,100	
San Francisco, State fish commission	2,527,000		
Sisson, State fish commission	22,796,645		
Illinois:			
Chicago, applicant	2,900		
Massachusetts:			
Wilkinsonville, State fish commission	50,000		
New York:			
Arden, Forest Lake	75,000		
Oregon:			
Clackamas, Clackamas River		6,297,155	572,300
Clear Creek			30,000
Estacada, Upper Clackamas River		2,200,600	
Grants Pass, Jones Creek		120,860	
Portland, State fish commission	1,000,000		
River Mill, Upper Clackamas River		600,900	
Selma, Illinois River		512,250	
Rancherie Creek		147,500	
Trail, Rogue River		2,266,714	
Wilderville, Applegate Creek		31,439	
Washington:			
Big White Salmon, Spring Creek		11,500,500	
Birdsview, Skagit River		54,940	
Cooks, Little White Salmon River			562,357
Darrington, Skagit River		3,060	
Duckabush, Duckabush River		42,000	
Illabott, Skagit River		100,300	
Little White Salmon, Little White Salmon River		11,833,400	200
Seuferts Cannery, Five Mile Creek		4,505,000	
Sultan, Elwell Creek		184,300	
Underwood, Big White Salmon River		2,837,000	477,948
Columbia River			90,000
Spring Creek		70,000	
Total	26,451,545	48,895,607	5,582,796

BLUEBACK SALMON.

Disposition.	Eggs.	Fry.	Fingerlings.
Alaska:			
Afognak, Ahuyon Creek		1,598,600	
Letnik Lake		6,163,105	
Eagle Lake, Eagle Lake	2,000,000		
Uganak Lake, Uganak Lake	1,970,000		
Yes Bay, Lake McDonald		23,582,600	
Yes River		19,143,800	
Oregon:			
Bonneville, State fish commission	2,000,000		
Washington:			
Baker Lake, Baker Lake		2,583,469	
Skagit River			120,000
Startup, State fish commission	50,000		
Total	6,020,000	53,071,574	120,000

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

HUMPBACK SALMON.

Disposition.	Fry.	Fingerlings, yearlings, and adults.
Alaska:		
Afognak, Ahuyon Creek	3,890,000	
Letnik Lake	8,144,399	
Yes Bay, Yes River	4,500,000	
Maine:		
Bangor, Penobscot River	236,250	
Brunswick, Androscoggin River	225,000	
Bucksport, Harriman Brook	92,000	
Smelt Brook	196,000	
Bucksport Center, Penobscot River	464,000	
Riches Brook	198,000	
Columbia Falls, Pleasant River	1,054,000	
Damariscotta Mills, Damariscotta River	1,056,000	
Dennysville, Dennys River	225,000	
East Orland, Alamoosook Lake	75,000	
Orland River	16,000	
Ellsworth, Union River	226,600	30,000
Orland, Orland River	1,716,072	
Penobscot, Pierce Pond	28,000	
Snowmans Pond	104,000	
Princeton, St. Croix River	300,000	
St. Croix River, West Branch	225,000	
South Penobscot, Whites Pond	28,000	
Waldoboro, Medomak River	352,000	
Warren, Georges River	352,000	
Washington:		
Baker Lake, Baker Lake		4,355
Birdsview, Grandy Creek	4,101,500	
Phinney Creek	335,000	
Skagit River	1,831,000	
Darrington, Skagit River	565,000	
Duckabush, Duckabush River	12,085,000	
Illabott, Illabott Creek	683,600	
Quilcene, Big Quilcene River	125,300	
Sultan, Elwell Creek	1,387,923	
Total [a]	44,817,644	34,355

[a] Lost in transit, 30,000 fry.

DOG SALMON.

Disposition.	Fry.
Washington:	
Birdsview, Grandy Creek	276,900
Skagit River	262,500
Darrington, Skagit River	745,410
Duckabush, Duckabush River	3,096,000
Illabott, Illabott Creek	18,500
Quilcene, Big Quilcene River	2,984,000
Little Quilcene River	1,285,000
Sultan, Elwell Creek	4,425
Total	8,672,735

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

STEELHEAD TROUT.

Disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Massachusetts:			
Lynn, Sluce Lake			3,000
Minnesota:			
French River, French River			6,700
Glenwood, State fish commission	50,000		
Knife River, Beaver River			5,000
Sucker River, Sucker River			7,000
Montana:			
Bozeman, Bridger Creek			335
Columbus, East Rosebud Lake			2,000
Elk Lake			2,000
Island Lake			2,000
Silver Lake			2,000
New Hampshire:			
Ashland, Squam Lake			6,000
Berlin, Silver Brook			2,000
Bristol, Newfound Lake			16,000
Laconia, Lake Winnesquam			35,000
State fish commission	50,000		
Pike, Lake Tarlton			4,000
Weirs, Lake Winnepesogee			35,085
New York:			
Cold Spring Harbor, State fish commission	50,000		
Raquette Lake, X-cuse Lake	100,000		
North Dakota:			
St. John, State fish commission	100,000		
Oregon:			
Applegate, Applegate Creek		9,968	
Clackamas, Clackamas River		97,700	
Estacada, Clackamas River		756,000	
Grants Pass, Applegate Creek		158,310	
Trail, Rogue River		1,208,030	
South Dakota:			
Fruitdale, Belle Fourche Reservoir			2,640
United States Reclamation Reservoir			77,000
Utah:			
Murray, State fish commission	50,000		
Vermont:			
Barton, Chrystal Lake			25,000
Bethel, White River			13,500
Hardwick, East Long Pond			3,000
Jericho, Browns River			9,500
Roxbury, State fish commission	50,000		
Rutland, Sunset Lake			5,860
South Royalton, Twinbridge River			9,000
Washington:			
Birdsview, Grandy Creek		742,225	
Duckahush, Duckabush River		603,000	
Illabott, Illabott Creek		287,505	
Ostrander, St. Helens Lake		10,000	
Quilcene, Big Quilcene River		37,700	
Spokane, State fish commission	29,000		
Sultan, Elwell Creek		112,000	
Walla Walla, Mill Creek	50,000		
Wisconsin:			
Ashland, Lake Superior			5,000
Pelican, Pelican Lake			15,000
Stone Lake, Big Sissabagamon Lake			10,000
State Line, Black Oak Lake			10,000
Wyoming:			
Laramie, State fish commission	50,000		
Total[a]	579,000	4,022,438	313,620

[a] Lost in transit, 8,000 fingerlings.

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

RAINBOW TROUT.

Disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Arizona:			
Flagstaff, Live Oak Creek			200
West Oak Creek			300
Kirkland, Genung's pond			300
Pinto, Henning's pond			100
Arkansas:			
Everton, Trammell's pond			100
Mountainburg, Frog Bayou			400
Pine Bluff, Hillcrest Lake			400
Prairie Grove, Pepper's pond			2,000
Siloam Springs, Grand View Lake			100
California:			
Brookdale, applicant	14,700		
Hornbrook, Cottonwood Creek		30,300	
Towle, Pioneer Creek			1,000
Colorado:			
Alamosa, Conejos River			292
Antonito, Conejos River	50,000		1,000
Aspen, Capitol Lake			15,000
Lost Man Lake			15,000
Snow Mass Lake			15,000
Upper Roaring Fork River			10,000
Basalt, Kelly's lake			5,000
Luchsinger Creek			5,000
Boulder, Middle Boulder Creek			300
Middle St. Vrain Creek			200
North Boulder Creek			300
North St. Vrain Creek			300
South Boulder Creek			300
South St. Vrain Creek			300
Buffalo, Lake Cheesman			8,000
Canon City, Arkansas River			400
Carr, Lone Tree Creek			400
Central City, Merz Lake			150
Cimarron, Cebolla Creek			268
Crystal Creek			268
Gunnison River			268
Johnson Park Lake			201
Lake Fork River			268
Little Cimarron River			268
Piney Creek			268
Soap Creek			268
Colona, Onion Creek Lake			120
Thompson Lake No. 1			120
Thompson Lake No. 2			120
Tie Camp Lake			120
Creede, Rio Grande			371
Sunnyside Creek			476
Cripple Creek, Frye Lake			2,000
Gillett & Victor Reservoir			3,000
Rule Creek Pond			2,000
De Beque, Leon Creek			150
Rowling's pond			50
Delta, Asha Mesa Pond			50
Denver, Platte River, South Fork			900
Dillon, Straight Creek			4,000
Ten Mile Creek			6,000
Dolores, Dolores River			120
Durango, Cascade Creek			130
Ebert Creek			130
Lime Creek			130
Eagle, Brush Creek			10,000
Eastonville, Whitmore's pond			150
Elbert, Horse Shoe Pond			500
Empire, Stanley Lake			400
Fort Collins, Cache La Poudre River, North Fork			300
Dale Creek			300
Dead Man Creek			300
Fish Creek			300
Spring Creek			100
Trail Creek			300
Fraser, St. Louis Creek			219
Vasquez Creek			146
Georgetown, Clear Lake			300
Duck Lake			300
Green Lake			300

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

RAINBOW TROUT—Continued.

Disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Colorado—Continued.			
Georgetown, Murray Lake			200
Naylor Lake			300
Randall's pond			100
Silver Dollar Lake			150
Glaciers, East River			1,080
Slate River			1,620
Taylor River			1,080
Washington Gulch Creek			1,620
Glenwood Springs, Grizzly Creek			10,000
No Name Creek			10,000
Granite, Rainbow Lake			12,000
Gunnison, Gunnison River			268
Taylor River			268
Hillside, Lake Creek			1,000
Hopkins, Frying Pan River			12,000
Lake George, South Platte River			4,000
La Veta, Cucharas River and branches			2,500
Leadville, Ault Lakes			5,000
Musgrove Lakes			14,000
Longmont, St. Vrain River, South Fork			3,500
Loveland, Big Thompson River			400
Big Thompson River, Millers Fork			3,300
Big Thompson River, North Fork			300
Big Thompson River, South Fork			4,400
Buckhorn River			300
Poudre River, Little South Fork			300
Lyons, Cave Creek			400
St. Vrain River, North Fork			400
Mayfield Spur, Burrow Creek			2,120
Lake Tressie			80
Meredith, Frying Pan River			15,000
Minturn, Cross Creek			12,000
Echo Lake			5,000
Gore Creek, headwaters			10,000
Moffat, Chapman's pond			1,000
Mid Valley Lake			4,000
Moffat Lake			500
Morris's pond			500
Saffell's pond			500
West Twin Lake			500
Parlin, Woodland Lake			67
Parshall, Grand River			292
Sander Ponds			146
Pitkin, Canon Creek			1,000
Woodland Lake			1,500
Pueblo, Oakdale Pond			100
Rico, Dolores River			120
Horse Gulch Creek			90
Ruedi, Rocky Fork Creek			18,000
Ruedi Lake			1,500
Sapinero, Gunnison River			335
Singleton, Eggert Lake			2,000
Snow Mass, Lake Sopris			4,000
South Platte, Notre Dame Lake			2,000
South Platte River			11,000
South Platte River, South Fork			10,000
Steamboat Springs, Elk River			219
Yampa River			219
Sulphur Springs, Troublesome River			219
Tabernash, Fraser River			3,000
Pole Creek			1,000
Ranch Creek			2,000
Trinidad, Las Animas River, Middle Fork			400
Una, Wallace Creek			160
Connecticut:			
Forestville, North Branch			1,200
Meriden, Quinnipiack River			300
Georgia:			
Blue Ridge, Coopers Creek			4,000
Oak Grove Pond			2,000
Toccoa River			10,000
Cole City, Cotter's lake			3,200
Nelson, Four Mile Creek			5,000
North Helena, Corbin Creek			3,800
Fodder Creek			2,000
Hog Creek			3,800

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

RAINBOW TROUT—Continued.

Disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Colorado—Continued.			
Rising Fawn, Lookout Creek			3,200
Turnerville, Panther Creek			2,000
Idaho:			
Ashton, Upper Sand Creek			3,000
Fort Lapwai, Sanatorium Pond			2,000
Idaho Falls, Lindgren's pond			1,000
Moyie Springs, Windy Pass Lake			2,000
Priest River, Big Creek			2,000
Pine Creek			2,000
Roberts, Ox Bow Creek			2,000
Sand Point, State fish commission	150,000		
Shoshone, Crystal Creek			500
Duck Lake			250
Little Weiser River			750
Indiana:			
Richmond, Rocky Hill Pond		3,000	
Iowa:			
Cedar Rapids, applicant	2,000		
Manchester, Riverside Trout Pond			20,000
Waterville, Little Paint River			900
Paint River			900
Kentucky:			
Hopkinsville, Campbells Branch			800
Lexington, Russell Cave Pond			100
Louisville, applicant	250		
Nortonville, Lake Norton			800
Woodburn, Chaney's pond			100
Maine:			
Eagle Lake, Cross Lake			3,000
Square Lake			2,400
East Orland, Craig Pond			94
Pembroke, Pennamaquan Lake			3,000
Maryland:			
Baltimore, State fish commission	30,000		
Good Hope, Squirrel Creek		11,159	
Knoxville, Little Catoctin Creek			2,000
Laurel, Thomas's pond		6,000	
Leonardtown, Town Run			300
Oakland, Helbigs Lake			800
North Cherry Creek			800
Youghiogheny River			2,400
Rockville, Spring Branch		9,676	
Ruxton, Poe's pond			100
Massachusetts:			
Athol, Swift River			300
Foxboro, Lake Neponset			600
Great Barrington, Konkapot River	25,000		1,200
Greenfield, Deerfield River			1,800
Green River			1,200
Lynn, Clough's pond			200
New Bedford, Bread and Cheese Creek		3,000	
Brightman Pond		3,000	
Collins Pond		3,000	
Copicut Creek		3,000	
Destruction Creek		3,000	
Fresh River		3,000	
Marys Pond		3,000	
Noquochoke River			2,000
Old Tucks Pond		3,000	
Paskamansett River		3,000	300
Shingle Island Creek		3,000	
Pittsfield, Morewood Pond			6,000
Sachem Brook			1,200
Town Brook			1,200
Shelburne Falls, Avery Brook		3,000	
Bear River			1,200
Clessons River		3,000	
Clam River			1,200
Stockbridge, Rawson Brook			1,200
Westfield, Little River			1,200
Loomis Street Brook			1,200

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

RAINBOW TROUT—Continued.

Disposition.	Eggs.	Fry.	Finger-lings, yearlings, and adults.
Michigan:			
Baldwin, Pere Marquette River			9,000
Buchanan, McCoy Creek			8,000
Crystal Falls, Lower Paint River			4,000
Delaware, Montreal River, upper			600
Grayling, Tillula Lake		12,000	
Mandan, Lake Medora			600
Montreal River, lower			600
Ojibway, Gratiot River			600
Phoenix, Silver River			600
Rose Center, Buckhorn Creek		10,000	
Crafts Creek		9,000	
Minnesota:			
Barden, Eagle Creek			600
Caledonia, Freeburg Creek			600
Riceford Creek			600
Sheldon Creek			600
West Beaver Creek			600
West Thompson Creek			600
Duluth, Ju Ju Lake			900
Minneapolis, Nine Mile Creek			1,200
Preston, Camp Creek			600
North Branch			400
South Branch			400
Trout Run			600
Watsons Creek			600
Ravenna, Crockery Creek			3,000
Missouri:			
Anderson, Aldrich's pond			2,000
Browns Spring, Rainbow Lake			5,563
Goodman, Trout Lake			200
Lebanon, Hahatonka Lake			8,500
Mount Vernon, Big Spring Creek			300
Billies Creek			400
Clear Creek			200
Clever Creek			400
Cove Springs Creek			400
Johnson Creek			400
Lower Turnback Creek			800
Mill Creek			470
Paris Springs Creek			500
Turnback Creek, headwaters			500
Neosho, Aldrich's pond			200
Pull Tight Brook			10,000
Potosi, Clear Spring Creek	25,000		
South St. Joseph, State fish commission	50,000		
Sparta, Lake Clear			100
Verona, Spring River			8,490
Webb City, Jenkins Creek			5,000
Montana:			
Baker, Mackay's pond			1,500
Belgrade, Story Creek		4,000	
Bozeman, Bridger Creek			193
Columbus, Castle Creek			2,000
Sioux Charley Lake			2,000
Stillwater River, West Fork			2,000
Conrad, Hirshberg's pond			3,800
Dillon, Rattlesnake Creek			4,000
Fort Hall, Spring Creek			2,800
Hobson, Beaver Pond			475
Ismay, Taylor Lake			1,500
Libby, Cedar Lake			1,000
Loon Lake			1,500
Manhattan, Bull Run		8,000	
McClellan Creek			2,000
Ridgeley Creek		8,000	
Marion, Edwards's lake			2,000
Ravelli, Crow Creek			1,000
Mud Creek			1,000
Spring Creek			500
Troy, Lake Kilbrennan			1,000
Spar Lake			1,500
Yellowstone, Madison River, South Fork			1,000
Nebraska:			
Chadron, Big Bordeaux Creek			1,000
Gordon, Whee Clay Creek			8,000
Gretna, State fish commission	100,000		

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

RAINBOW TROUT—Continued.

Disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Nevada:			
Verdi, State fish commission	98,000		
New Hampshire:			
Fabyans, Black Brook			1,200
Laconia, State fish commission	50,000		
Lakewood, Ossippee Lake			3,000
Peterborough, Contoocook River			2,850
Potter Place, Cole Pond		5,795	
New Jersey:			
Passaic Park, Rusby's pond			1,600
Westwood, Lake Superior			1,600
Stanford's pond			150
New Mexico:			
Embuda, Santa Barbara River			500
Estancia, Tajique Creek			100
Espanola, Cebolla Creek			200
Coyote Creek			200
Glorietta, Spirit Lake			200
Jaroso, Reta del Medio Creek			120
Las Vegas, Gajanas Creek			400
Rio de La Casa			200
Rio de La Casa, South Fork			200
Rito de los Lujanas			100
Spring Blue Pond			200
Magdalena, Spring Pond			200
Onava, Lake Isabell			400
Raton, Bear Creek			200
Ute Park, Bitter Creek			200
Red River			200
New York:			
Albany, Ten Eyck's pond			1,200
Apulia, Conklin Brook			100
Markham Hollow Brook			300
Bellina, New Woodstock Brook			300
Benson Mines, Star Lake		2,820	
Canaan, Canaan Center Pond			100
Davenport, Middlebrook Creek			3,200
Elmsford, Fir Cones Pond			165
Georgetown, Otselic Creek			300
Hornell, Canacadea Creek			2,400
Neils Creek			2,400
Seeley Creek			2,400
Seeley Creek, North Branch			1,600
Huntington, Rosemary Pond			500
Lake Mahopac, Lake Mahopac			7,200
Locust Valley, Bailey's pond			300
New York City, New York Aquarium	5,000		
Oneonta, Hotaling Hollow Brook			1,600
Rome, Big Alder Creek		2,820	
Sherburne, Smyrna Brook		2,820	
Syracuse, Butternut Creek			300
Chittmong Creek			300
Limestone Creek			400
Unadilla, Electric Pond			800
North Carolina:			
Addie, Scotts Creek			300
Altapass, Cane River and tributaries			31,750
Biltmore, Maple Spring Lake			2,000
Black Mountain, Long Branch			5,000
Sugar Fork Creek			5,000
Swannanoa River, North Fork			10,000
Brevard, Conastee Creek			200
Tucker Creek			500
Bridgewater, Linville River			400
Bryson, Ball Creek			200
Bear Creek			200
Bear Pen Creek			200
Bee Tree Creek			200
Big Creek			200
Bridge Creek			200
Cherry Creek			100
Clingman Creek			200
Deep Creek			200
Deep Creek, Left Fork			200
Deep Creek, Right Fork			200
Indian Creek			200

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

RAINBOW TROUT—Continued.

Disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
North Carolina—Continued.			
Bryson, Inman Creek			200
Kirkland Creek			200
Linville Creek			200
Bryson, Long Branch			200
Mingers Creek			200
Nettle Creek			200
Poll Road Creek			200
Rock Creek			200
Tuckaseigee River			200
Cherryfield, Cherryfield Creek			600
Ciniard Creek			1,500
Mason Creek			600
Paxtons Creek			1,200
Weaver Creek			900
Craggy, Alexander's pond			100
Cranberry, Toe River			4,000
Dillard, Cullasaja River, headwaters			3,500
Elk Park, Curtis Creek			2,000
Galax, Fighting Creek			10,000
Gilkey, Cedar Creek			1,500
Graphiteville, Mill Creek			300
Hendersonville, Big Hungry Creek			5,000
Henrietta, Hinsdale's pond			600
Hickory, Cook's pond			1,000
Potts Creek			1,500
Hominy, Beaverdam Creek			5,000
Stony Fork Creek			5,000
Linville Falls, Linville River			21,000
Catawba River, South Fork			7,500
Marshall, Ramsey's pond			100
Robert's pond			100
Mount Sterling, Big Creek			2,300
Chestnut Creek			2,200
Newton, Warlick Mill Creek			1,500
North Wilkesboro, Elk Creek			3,300
Townsend's pond			600
Penrose, Crabe Creek			200
Hookers Mill Creek			200
Lake Aikenside			200
Loftis Mill Creek			200
Lidays Creek			200
Mill Creek			200
Resinover Creek			200
Thomas's lake			1,200
Quebec, Flat Creek			300
Rutherfordton, Cedar Creek			1,500
Charlie Creek			1,500
Silica, Catheys Creek			200
Skyland, Pelzer's pond			100
Spruce Pine, Grassy Creek			5,000
Sylva, Bear Creek			10,000
Camp Creek			200
Flat Creek			200
Flint Creek			100
Grassy Creek			200
Locust Creek			200
Moses Creek			200
Moss Creek			100
Welch Creek			200
Wilson Creek			200
Tryon, First White Oak Creek			3,000
Horse Creek			3,000
White Oak Creek			4,000
Tuxedo, Bennyfield Creek			2,500
Bohr Creek			5,000
Green River			5,000
Green River, above falls			5,000
North Dakota:			
St. John, State fish commission	100,000		
Ohio:			
Belleville, Clearfork Creek, North Branch			300
Clearfork Creek, South Branch			300
Mansfield, Baer's pond			100
Brinkerhof's pond			200
Brubaker Run			300

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

RAINBOW TROUT—Continued.

Disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Ohio—Continued.			
Mansfield, Coes Run			200
Cullers Run			300
Dickson Run			200
Jeromeville Creek			300
Mohican River, Black Fork			300
Whetstone Creek			300
Newark, Shawnee Run		6,000	
Oklahoma:			
Maud, Hilton's pond			200
Oregon:			
Bonneville, State fish commission	200,000		
Harrisburg, Big Lake		5,000	
Lakeview, Willow Creek			1,500
Pennsylvania:			
Andreas, Fritz Creek			2,000
Gerbers Creek			3,000
Ohls Creek			3,000
Ansonia, Kettle Creek			4,000
Coburn, Singing Brook			2,000
Hughesville, Big Muncy Creek			10,000
Johnstown, Baker Run			3,000
Barefoot Run			4,000
Beaverdam Creek			3,000
Beaverdam Run			4,300
Bens Creek			7,000
Blue Hole Run			3,000
Bobs Creek			4,000
Bottle Run			3,000
Breast Works Creek			4,000
Brush Creek			4,000
Calender Run			4,000
Clear Run			3,000
Coxes Creek			4,300
Cranberry Glade Creek			3,000
Elk Lick Run			4,000
Figart Run			4,300
Flaugherty Creek			300
Laurel Run			300
Lick Creek			300
Little Pine Run			300
Negro Glade Run			300
Pine Run			300
Shaffer Run			3,000
Sweet Run			3,000
Town Line Run			3,000
West Branch			3,300
Whites Creek			4,300
Kellettville, Bear Creek			2,000
Branch Run			2,300
Fork Run			200
Four Mile Run			2,200
Lark Run			2,000
Mud Lick Creek			200
Salmon Creek			2,300
Six Mile Run			2,200
Lancaster, Landis Run			2,000
Lansdale, Spring Creek			200
Lemont, Gilbreath Gap Creek			4,000
Laurel Run			6,000
Roaring Run			4,000
Slab Cabin Creek			6,000
Ligonier, Mill Creek and tributaries			450
Minersville, Buck Run			300
Juggler Creek			300
Wolf Creek			300
Nazareth, Kramer's pond			250
New Ringgold, Cold Run			3,000
Philipsburg, Benner Run			300
Black Bear River			300
Black Moshannon River			300
Clover Run			200
Coal Stream River			300
Hutten Run			200
Six Mile Run			300
Smayes Run			300
Tom Tit Creek			200

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

RAINBOW TROUT—Continued.

Disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Pennsylvania—Continued.			
Philadelphia, Fairmont Park Aquarium			10
Reading, Oley Valley Pond			4,000
Renovo, Bakers Run			5,000
Barneys Run			5,000
Big Run and branches			5,000
Cranberry Run			13,000
Drurys Run and branches			5,000
Fish Dam Run			5,000
Halls Run			5,000
Hyner Run and branches			5,000
Paddys Run and branches			5,000
Shintown Run			5,000
Susquehanna River, West Branch			15,000
Young Womans Creek			5,000
Rowland, Westfall Brook			400
Williamsport, Lower Mill Creek			1,600
Windber, Big Shade Creek			1,000
Clear Shade Creek			1,000
Dark Shade Creek			1,000
Piney Run			1,000
Roaring Fork Creek			1,000
Sandy Run			1,000
Shade Creek			1,000
Winburne, Forge Run			800
South Carolina:			
Blacksburg, Buffalo Creek			4,000
Greenville, Devils Fork Creek			2,500
Fall Creek			5,000
Hawk Creek			2,500
Mule Pen Branch			2,500
North Saluda River			5,000
South Dakota:			
Custer, French Creek			4,000
Elmore, Spearfish River			3,500
Fruitdale, Stearn's pond			1,000
Gustave, Henderson's pond			1,000
Hill City, Spring Creek			4,000
Isabell, Red Earth Creek			2,975
Kadoka, Willow Lake			1,000
Mystic, Canyon Lake			1,000
Castle Creek			2,000
Electric Light Pond			2,000
Hall's pond			1,000
Harveys Lake			3,000
Minnelusa Creek			1,000
Tunnell Creek			1,000
Rochford, East Gimlet Creek			2,000
Little Rapid Creek			3,000
North Castle Creek			1,000
Spearfish, Crystal Springs Pond			2,000
Kingsley's lake			1,000
Minnekahta Lake			1,000
Robinsons Lake			2,000
Smiths Spring Creek			500
Spearfish Creek			4,000
Spearfish Creek, branch of			1,000
Spearfish Creek, Curnow Branch			500
Summers's pond			1,000
Walton's lake			1,000
Tilford, Jordan's pond			3,000
Whitewood, Christensen's pond			1,000
Tennessee:			
Afton, Middle Creek			200
Bulls Gap, Sulphur Valley Creek			4,000
Cleveland, Stonecipher's pond			800
Crandall, Beaverdam Creek			3,750
Doe River, Doe River			20,000
Elkmont, Little River			16,000
Little Pigeon River, West Fork			4,000
Erwin, Toney Creek			400
Fishery, North Indian Creek			107,400
Gray, Dunlap Creek			3,000
Holston Creek			2,000
Sells's pond			1,000
Hampton, Laurel Fork Creek			4,000

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

RAINBOW TROUT—Continued.

Disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Tennessee—Continued.			
Hollow Rock Junction, Hollow Rock Creek			4,000
Johnson City, Carter's pond			2,500
Lakeside Lake			2,000
Newport, Big Creek			5,000
Okalona, Buffalo Creek			10,000
St. Bethlehem, Spring Creek			4,800
Sevierville, Pigeon River, East Prong			9,600
Shell Creek, Bear Creek			5,000
Valley Forge, McCathern Creek			2,000
Vermont:			
Brandon, East Creek			1,500
Leicester River			2,000
Middlebury River			2,000
Sucker Brook			2,000
East Hardwick, Hale Brook			1,000
Edgewater, Niggerhead Pond			1,500
Virginia:			
Abingdon, Honaker's pond			500
Barron, Seveets Creek			150
Blair, Chestnut Creek			2,000
Clifton Forge, Smiths Creek			10,000
Wilson Creek			10,000
Columbia, Baker's pond			2,000
Covington, Iron company's creeks			1,500
Culpeper, Mountain Pond			300
Elkton, North River			725
Fredericksburg, Snow Creek			5,000
Goodview, Jumping Run			2,000
Harrisonburg, Dry Run			1,500
Hot Springs, Jackson River			8,000
Huddleston, Waldron Creek			5,000
Island Fork, Big Run			700
Jasper, Wallens Creek			3,750
Konnarock, Green Cove Creek			40,000
White Top Creek			38,600
Lexington, Buffalo Creek			375
Hottinger's pond			1,000
North River			375
South River			375
Longdale, Simpson Creek			15,000
Lovettsville, Dutchman Run			450
Low Moor, Karnes Creek			600
Millboro, Back Creek			6,000
New Castle, Sinking Creek			3,000
Orange, Spring Branch Pond			1,000
Pembroke, Lybrook Pond			100
Pulaski, Cool Spring Lake			500
Harman's pond			4,000
Richmond, Laurel Pond			1,000
Saltville, Tumbling Creek			4,000
Springfield, Accotink Run			2,000
Staunton, Big Calf Pasture River			10,000
Stokesville, North River			8,800
Stuart, South Mayo Creek			3,000
Wytheville, Walker's pond			2,000
Washington:			
Elberton, Clear Lake			3,000
Northport, Big Sheep Creek			2,000
Deep Lake			2,000
Five Mile Lake			2,000
Silver Crown Lake			2,000
Pomeroy, Deadman Creek			1,000
Houser's pond			1,000
Pollard, Curlew Lake			2,000
Port Angeles, Pleasant Lake			3,000
Republic, Amy Lake			2,000
Copper Lake			2,000
Crawfish Lake			2,000
Seattle, Sandy Lake		7,500	
Sumner, Glen Acorn Creek		1,000	
Glen Acorn Pond		1,000	
Wilbur, Wilbur Creek			1,000
West Virginia:			
Bartow, Deer Creek			600
Clover Lick, Clover Creek			600

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

RAINBOW TROUT—Continued.

Disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
West Virginia—Continued.			
Harman, Hazlewood Run			200
Kearneysville, Lake "B"			1,000
Marlinton, Swago Creek			1,000
Martinsburg, Highland Orchard Pond			400
Midvale, Cassity Brook			400
Middle Fork River			800
Mullens, Slab Fork Creek			1,000
Pullman, Baker's pond			200
Huses River, South Fork			800
Sewell, Mans Creek			800
Terra Alta, Little Youghiogheny River, branch of			200
Youghiogheny River, tributary			200
White Sulphur Springs, Howards Creek			25,000
Wisconsin:			
Appleton, Gloudeman's pond			500
Chippewa Falls, Duncan Creek			6,000
Dunbar, Coleman Lake			1,000
Moon Lake			1,000
Elroy, Fowlers Creek			600
Seymour Creek			900
Independence, Bruce Valley Creek			1,000
Chimney Rock Creek			1,500
Davis Creek			1,000
Elk Creek			2,000
Finright Creek			500
Killness Creek			500
North Branch Creek			1,000
Skogstads Creek			500
Wares Creek			500
Wickham Creek			1,000
Kendall, Brainards Creek			300
Lumsden Creek			600
Tunnell Creek			600
Lyndhurst, Martin Aaron Lake			1,000
Manitowoc, Pierce Creek			500
Mount Horeb, Blue Mounds Creek			1,000
Brager Stream			500
Forward Stream			1,000
Klevenville Stream			1,000
Noon Creek			1,000
Oakfield, Fond du Lac River, headwaters			1,000
Radison, Count Oreilles River			600
Kenyon Creek			300
Richland Center, Willow Creek			600
Sparta, Big Creek, Upper			900
Westby, Kickapoo River, West Branch			300
Wyoming:			
Beulah, Crawford Pond			1,000
Hidden Spring Creek			1,000
Sand Creek			4,000
Rice Springs Creek			1,000
Clearmont, Piney Creek			1,600
Elk Mountain, Blood Lake			4,000
Evanston, Bear River			4,000
Lander, Popo Agie River			5,000
Ranchester, Big Goose Creek, headwaters			6,400
Sheridan, Smith's pond			700
State fish commission	192,000		
Sundance, McGuigan's pond			500
Medicine Flat Lake			2,500
Morgan's pond			500
Spring Lake			1,000
Thermopolis, Owl Creek			3,000
Worland, Spring Creek			5,000
Total [a]	1,091,950	181,890	1,656,229

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[a] Lost in transit, 30,708 fingerlings.

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

ATLANTIC SALMON.

Disposition.	Fry.	Fingerlings.
Maine:		
East Bucksport, Penobscot River	241,512	
East Orland, Alamoosook Lake		16,993
Penobscot River	2,331,783	
Total	2,573,295	16,993

LANDLOCKED SALMON.

Disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Connecticut:			
Falls Village, Housatonic River			6,500
Maine:			
Abbott Village, Sebec Lake			6,000
Belfast, Swan Lake			3,000
Bigelow, Big Tee Pond			4,000
Little Tee Pond			5,000
Bingham, Clear Pond			4,000
Pierce Pond			10,000
Blanchard, Doe Pond			3,000
Mud Pond			3,000
Boothbay Harbor, Campbell Pond			3,000
Brooks, Passagassawaukeag Pond			4,000
Bryants Pond, Twitchell Lake			5,000
Eagle Lake, Eagle Lake			3,000
East Orland, Craig Pond			57
Eastport Junction, Cathance Lake		6,000	
Farmington, Clear Water Pond			3,000
Grand Lake Stream, Dobsis Lake		90,000	12,000
Grand Lake		216,486	21,709
Green Lake, Green Lake			29,500
Greenville, Roach River			4,000
Harrison, Island Pond			2,000
Jackman, Big Fish Pond			2,000
Duncan Lake			4,000
Enchanted Creek			3,000
Enchanted Lake			3,000
Jones Pond			4,000
Little Enchanted Pond			3,000
Lower Enchanted Pond			3,000
Kennebunk, Kennebunk Pond			3,000
Kineo, Moose River			6,000
Moosehead Lake			5,000
Roach River			1,000
McGeorge, Cathance Lake			431
Mattocks, Peabody Pond			4,000
Monson Junction, Lake Juanita			3,000
Piper Pond			4,000
New Castle, Little Pond			3,500
Newport Junction, Lake Sebasticook			3,000
Nicolin, Branch Pond			3,000
North Belgrade, State fish commission	100,000		
Norway, Lake Pennesawassee			5,000
Virginia Lake			2,500
Otis, Green Lake			37,000
Patten, Shin Pond			4,000
Portage, Portage Lake			6,000
Rangeley, Loon Lake			5,000
South Paris, Concord Pond			5,000
Southwest Harbor, Great Lake			3,000
Strong, Porter Pond			5,000
Thorndike, St. George Lake			4,000
Tunk Pond, Tunk Pond			5,000
Waldoboro, Peters Pond			3,000
Winterville, St. Fraid Lake			6,000
Massachusetts:			
Pittsfield, Morewood Pond			6,000
Worcester, Lake Quinsigamond			1,000

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

LANDLOCKED SALMON—Continued.

Disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Michigan:			
Sault Ste. Marie, St. Marys River	25,000		
Minnesota:			
Knife River, Echo Lake			2,500
Fan Lake			2,500
Maple Lake			2,500
Micmac Lake			2,500
Nepissquit Lake			2,500
Schauff Lake			2,500
Sheet Lake			2,500
South Crooked Lake			2,500
Tettegouche Lake			2,500
Upper Baptism River			2,500
St. Paul, State fish commission	15,000		
New Hampshire:			
Bartlett, Upper Sawyer Pond		3,500	
Colebrook, State fish commission	30,000		
Enfield, Cole Pond			4,610
Franklin, Webster Lake			4,000
Keene, Spofford Lake			500
Meredith, Lake Winnepesaukee			500
Weirs, Lake Winnepesaukee			6,000
New Jersey:			
Hackettstown, State fish commission	10,000		
New York:			
Carmel, Croton River, Reservoir "D"			500
Lake Gleneida			500
Fulton, State fish commission		13,750	
Long Lake West, Doctors Pond	15,000		
New York City, New York Aquarium	1,000		
Raquette Lake, Lake Kora	50,000		
Tuxedo, applicant	10,000		
Rhode Island:			
Apponaug, Sand Pond			2,500
Vermont:			
Averill, Averill Lake			1,500
Little Averill Lake			1,500
Greensboro, Caspian Lake			1,650
Island Pond, Seymour Lake			375
Orleans, Long Pond			1,000
Willoughby Lake			1,500
Roxbury, State fish commission	20,000		
Salisbury, Lake Dunmore			1,000
Wisconsin:			
Ashland, Lake Superior			1,500
Centuria, Balsam Lake			3,000
Twin Bears, Lake Thirteen			4,000
Waupaca, Chain of Lakes			8,000
Total[a]	276,000	329,736	356,332

[a] Lost in transit: 2,000 fingerlings, 500 fry.

SCOTCH SEA TROUT.

Disposition.	Fingerlings, yearlings, and adults.
Maine:	
East Orland, Alamoosook Lake	10,000
Craig Pond	2,454
Toddy Pond	7,942
Total	20,396

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

BLACKSPOTTED TROUT.

Disposition.	Eggs.	Fry.	Fingerlings.
Colorado:			
Alamosa, Rio Grande			13,000
Aspen, Anderson Lake			15,000
Castle Creek			20,000
Lostman Lake			15,000
Maroon Lake			20,000
Austin, Dirty George Creek			8,000
La Reaux Creek			8,000
Surface Creek			8,000
Ward Creek			8,000
Baldwin, Anthracite Creek			6,000
Castle Creek			4,000
Mill Creek			8,000
Pass Creek			6,000
Bear Creek, Bear Creek			9,000
Boulder, Beaver Park Lake			5,000
Brainard Lake			5,000
Goose Lake			5,000
Long Lake			5,000
Brown, Alder Creek			12,000
Hay Creek			7,000
Leopard Creek			10,000
Buena Vista, Day Pond			5,000
Cascade, French Creek			3,000
Cebolla, Gunnison River			50,000
Cimarron, Little Cimarron River			12,000
Mesa Creek			5,000
Coke Ovens, Fish Creek			3,000
Ground Hog Creek			2,000
West Dolores River			4,000
Colorado Springs, McReynolds Lakes			60,000
Teeter's pond			5,000
Como, Four Mile Creek			15,000
Creede, applicant	230,000		
Miners Creek			10,000
Pole Creek			4,500
Rio Grande, Upper			40,000
Squaw Creek			4,500
Trout Creek			4,500
Ute Creek			4,500
Cripple Creek, railway streams			30,000
De Beque, Big Creek			4,000
Bull Creek			8,000
Buzzard Creek			10,000
Coon Creek			8,000
Grove Creek			8,000
Hawxhurst Creek			8,000
Lennox Creek			8,000
Leon Creek			8,000
Mesa Creek			8,000
Park Creek			8,000
Plateau Creek			14,000
Salt Creek			8,000
Delta, Bonnell Gulch Creek			12,000
Escalante Creek			12,000
Denver, State fish commission	600,000		
Dillon, Black Beaver Ponds			3,000
Slate Creek			15,000
Slate Lake			15,000
Snake River			15,000
Straight Creek			15,000
Surprise Lake			15,000
Willow Creek			15,000
Durango, Cascade Creek			4,000
Florida Creek			5,000
Hermosa Creek			4,000
Vallecito Creek			4,000
Dyke, Piedra River			20,000
Fraser, Ranch Creek			3,000
St. Louis Creek			3,000
Glaciers, East River			8,000
Slate River			8,000
Washington Gulch Creek			8,000
Glenwood Springs, Eagle River and tributaries			30,000
Grant, Geneva Creek			5,000
South Platte River, North Fork			125,000
Gypsum, Deep Creek			6,000
Sweetwater Creek			8,000
Hartsel, South Platte River and tributaries			24,000

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

BLACKSPOTTED TROUT—Continued.

Disposition.	Eggs.	Fry.	Fingerlings.
Colorado—Continued.			
Hierro, North Beaver Creek			8,000
Sun Creek			6,000
Hillside, Brush Creek			8,000
Hotchkiss, Clear Fork Creek			8,000
Crystal Creek			6,000
Smiths Fork Creek			6,000
Howard, Arkansas River			26,000
Lake George, South Platte River, South Fork			8,000
Tarryall Creek			8,000
Longmont, Big Thompson River			20,000
Los Pinos, Los Pinos River, South Fork			10,000
Lyons, St. Vrain River, Middle Fork			8,000
St. Vrain River, South Fork			10,000
Malta, Eagle River			30,000
Holy Cross Creek			30,000
Sweetwater Lake			25,000
Two Elk Creek			25,000
Mancos, Lost Canyon Creek			4,000
West Mancos River			4,000
Marshall, Agate Creek			6,000
Marshall Creek			6,000
Middle Creek			6,000
Poncho Creek			6,000
Silver Creek			6,000
South Boulder Creek			7,000
Monte Vista, Alamosa River			8,000
Conejos River			10,000
New Castle, East Elk Creek			8,000
East Rifle Creek			8,000
Middle Elk Creek			8,000
Newcomb, Boulder Creek, South Fork			10,500
Newett, Teeter's pond			3,000
Norrie, Koch's pond			10,000
Ouray, Lake Lenore			12,000
Uncompahgre River, East Fork			10,000
Pagosa Springs, Fish Creek			6,000
Four Mile Creek			6,000
Piedra River, East Fork			6,000
Piedra River, First Fork			6,000
Quartz Creek			6,000
Sand Creek			6,000
San Juan River, East Fork			6,000
San Juan River, West Fork			6,000
Silver Creek			6,000
Weminuche Creek			11,000
Williams Creek			6,000
Wolf Creek			6,000
Paonia, East Muddy Creek			8,000
Hubbard Creek			8,000
Terror Creek			6,000
West Muddy Creek			8,000
Parshall, Battle Creek			10,000
Carr's pond			4,000
Williams Fork Creek			12,000
Williams Fork Creek, South Fork			10,000
Pitkin, Quartz Creek			14,000
Placerville, Beaver Creek			4,000
Pueblo, Graneros Creek			6,000
St. Charles Creek, South Fork			8,000
Rico, Barlow Creek			10,000
Dolores River			15,000
East Dolores River			5,000
Scotch Creek			3,000
Ridgeway, Cow Creek			10,000
Big Cimarron Creek			10,000
Little Cimarron Creek			10,000
St. Elmo, Red Mountain Creek			8,000
Taylor River			12,000
Texas Creek			8,000
Willow Creek			8,000
Salida, Arkansas River			5,000
Sapinero, Currecanti Creek			8,000
Sapinero Creek			8,000
West Elk Creek			8,000
Sellar, Sellar Creek			36,000
South Forks, Beaver Creek			6,000
Rio Grande, South Fork			8,000

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

BLACKSPOTTED TROUT—Continued.

Disposition.	Eggs.	Fry.	Fingerlings.
Colorado—Continued.			
Steamboat Springs, Aqua Fria Lake			3,000
Chedsey Lake			3,000
Lone Pine Lake			3,000
Newcomb Lake			3,000
Walton Lake			3,000
Vance Junction, Bilk Creek			3,000
Vasquez, Frazer River			8,000
Vasquez Creek			6,000
Villa Grove, Garner Creek			6,000
Major Creek			6,000
Westcliffe, Harns Creek			10,000
Sand Creek Lake			10,000
South Colony Creek			6,000
Wheeler, West Ten Mile Creek			15,000
Woodland Park, Trout Creek			12,000
Turkey Creek			12,000
West Creek			12,000
Yampa, Bear River			3,000
East Williams Fork Creek			3,000
Fish Creek			3,000
Middle Derby Creek			12,000
North Derby Creek			6,000
Oak Creek			3,000
Trout Creek			3,000
Youman, Big Blue Creek			10,000
Idaho:			
Boise, State fish commission	205,000		
Fort Hall, Clear Creek		6,000	
Ross Fork Creek		12,000	
Priest River, Priest Lake		8,000	
Shoshone, North Fork Payette River Pond		6,000	
Salmon River		5,500	
Michigan:			
Detroit, Detroit Aquarium	5,000		
Montana:			
Anaconda, California Creek		4,000	
Deep Creek		4,000	
Dutchman Creek		4,000	
Fish Trap Creek		6,000	
Foster Creek		4,000	
Lost Creek		6,000	
Mill Creek		6,000	
Race Track Creek		8,000	
Warm Spring Creek		6,000	
Willow Creek		4,000	
Ballantine, Arrow Creek			9,000
Belt, Stoner Creek		5,200	
Big Timber, Big Timber Creek, South Fork		7,500	
Billy Creek		5,000	
Boulder Pond		5,000	
Boulder River		10,000	
Cayuse Creek		7,500	
Deer Creek, lower		7,500	
Swamp Creek		7,500	
Sweet Grass River		7,500	
Wheeler Creek		7,500	
Yellowstone River			9,000
Bozeman, Buck Creek			2,200
Carlin Creek		2,800	
Cockrell Creek			1,200
Dry Creek, North Fork			800
Fish Creek		4,400	
Middle Creek		8,000	
Nixon Creek			1,400
South Cottonwood Creek		8,000	
Broadus, Edwards Lake			600
Butte, applicant	680,000		
Columbus, East Rosebud Creek		5,000	
Fishtail Creek		7,500	
Spring Creek		5,000	
Stillwater River		16,000	
Trout Creek		5,000	
West Rosebud Creek		7,500	
Emigrant, Spring Creek			750
Hamilton, Bitter Root River		8,000	
Bitter Root River, East Fork		4,000	
Bitter Root River, West Fork		4,000	
Blodgett Creek		4,000	

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

BLACKSPOTTED TROUT—Continued.

Disposition.	Eggs.	Fry.	Fingerlings.
Colorado—Continued.			
Hamilton, Girds Creek		4,000	
Lost Horse Creek		4,000	
Lost Horse Creek, South Fork		4,000	
Roaring Lion Creek		4,000	
Rock Creek		4,000	
Saw Tooth Creek		4,000	
Skalkaho Creek		4,000	
Sleeping Child Creek		4,000	
Havre, Beaver Creek		12,000	
Box Elder Creek		12,000	
Hobson, Judith River, South Fork		10,400	
Livingston, Rock Creek			12,000
Shady Nook Pond		6,000	
West Boulder River		16,000	
Yellowstone River		26,000	1,200
Manhattan, Baker Creek		10,000	
Missoula, Bitter Root River		12,000	
Blackfoot River		12,000	
Fish Creek		12,000	
Lo Lo River		8,000	
Monteaur Creek		8,000	
O'Brien Creek		6,000	
Rattlesnake Creek		10,000	
Rock Creek		8,000	
Somers, State fish commission	636,240		
Spionkop, Alber's pond		2,600	
Highwood Creek		10,400	
Superior, Cedar Creek		5,000	
Deep Creek		5,000	
Dry Creek		7,500	
Fish Creek		10,000	
Fourteen Mile Creek		5,000	
Oregon Creek		5,000	
Quartz Creek		7,500	
St. Regis Creek		10,000	
Thompson Creek		5,000	
Trout Creek		5,000	
Wilsall, Flathead Creek			1,500
Shields River			450
Winston, Stanback Pond		6,000	
Nebraska:			
Chadron, Beaver Creek			20,000
Little Bordeaux Creek			20,000
New Mexico:			
Cimarron, Rayado River			4,000
South Poniel River			3,000
Glorietta, Holy Ghost Creek			1,000
Indian Creek			1,000
Macho Creek			1,000
Panchuelo Creek			1,000
Pecos River			5,000
Las Vegas, Mora River			5,000
Raton, Sugarite River			8,000
Santa Fe, Nambe River			6,000
Santa Fe River			2,000
Tesuque River			3,000
Ute Park, Cimarron River, Upper			2,500
Talby River			2,500
Wagon Mound, Tyson Spring Creek			1,000
Vermejo Creek			1,000
New York:			
New York City, New York Aquarium	25,000		
Oregon:			
Portland, State fish commission	200,000		
Rogue River, Rogue River		17,630	
South Dakota:			
Big Bend, Minnelusa Ponds			5,000
Deadwood, Graff Pond			3,000
Dewey, Drew Springs Pond			3,000
Elmore, Spearfish Creek			20,000
Spearfish Creek, East Branch			2,500
Englewood, Whitewood Creek			24,000
Fairburn, French Creek			20,000
Lantry, Bear Creek Reservoir			10,000
Merrill, Horse Creek			3,000
Mystic, Antlers Lake			16,000
Bogus Jim Creek			8,000
Castle Creek			20,000

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

BLACKSPOTTED TROUT—Continued.

Disposition.	Eggs.	Fry.	Fingerlings.
South Dakota—Continued.			
Mystic, Dakota Power Pond			2,400
Lime Creek			4,000
Minnelusa Pools			5,000
Minnelusa Run			4,000
Prairie Creek			15,000
Rapid Creek			28,000
Slate Creek			4,600
Victoria Creek			15,000
Rapid City, Blodgett-Gray Run			10,000
Box Elder Creek			25,000
Cleghorn Pond			5,000
Platt Pond			10,000
Rapid Creek			25,000
Spring Creek			25,000
Spruce Creek			5,000
Rochford, Jim Creek			11,000
Rapid Creek			21,000
Roubaix, Elk Creek			25,000
North Elk Creek			10,000
Silver City, Rapid Creek			45,000
Spearfish, Crow Creek			10,000
Schmidt Lake			10,000
Spearfish Creek, Deadwood Branch			5,000
Sturgis, Bear Butte Creek			20,000
Whitewood, Spring Creek			5,000
Washington:			
Collins, Rocky Creek		3,800	
Elma, Cloqualum Creek		9,000	
North Yakima, Lost Lake		6,000	
Tacoma, American Lake		5,000	
Steilacook Lake		5,000	
Wyoming:			
Beulah, Sand Creek			3,000
Clear Creek, Clear Creek		12,000	
Chain of Lakes		20,000	
Cody, Crow Creek		12,000	
Jones Creek		8,000	
Middle Creek		15,000	
Shoshone River, North Fork		22,500	
Shoshone River, South Fork		20,000	
Eleanor Lake, Eleanor Lake		28,500	
Lander, Big Popo Agie River		45,000	
Big Popo Agie River, headwaters		63,000	
Laramie, Little Laramie River		30,000	
State fish commission	200,000		
Pelican Lake, Pelican Lake		25,000	
Rock River, Rock Creek		40,000	
Rock Springs, Half Moon Lake		12,000	
New Fork Lake		12,000	
Story, State fish commission	600,000		
Sylvan Lake, Sylvan Lake		22,800	
Total[a]	3,381,240	967,530	2,442,100

[a] Lost in transit 33,000 fry; 25,000 fingerlings.

LOCH LEVEN TROUT.

Disposition.	Fingerlings.
South Dakota:	
Savoy, Little Spearfish Creek	46,500

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

LAKE TROUT.

Disposition.	Eggs.	Fry.	Fingerlings.
Maine:			
Bridgton, Highland Lake			6,000
Moose Pond			6,000
Woods Pond			6,000
Byron, Garland Pond			12,000
Dedham, Phillips Lake			25,000
Enfield, State fish commission	50,000		
Farmington, Varnums Pond			6,000
Jackman, Lake Wood			6,000
La Grange, Boyd Lake			9,000
Onawa, Onawa Lake			7,500
Otis, Green Lake			5,653
Massachusetts:			
Greenwich, Quabbin Lake			6,000
Michigan:			
Beaver Island, Lake Michigan		2,725,000	
Big Rock Reef, Lake Michigan		750,000	
Charlevoix, Lake Michigan		3,750,000	
Pine Lake		400,000	
Crystal Falls, Upper Holmes Lake			20,000
Detour, Lake Huron		1,000,000	
Escanaba, Lake Michigan		150,000	
Fish Island, Lake Superior		960,000	
Fishermens Home, Lake Superior		1,160,000	
Fishermens Island, Lake Michigan		1,000,000	
Fishermens Reef, Lake Michigan		1,600,000	
Grand Portage, Lake Superior		300,000	
Greenville, Baldwin Lake		24,000	
Howell, Long Lake		24,000	
Irishman Reef, Lake Michigan		1,000,000	
Isle Royale, Lake Superior			180,000
Little Rapids, St. Marys River		200,000	
Long Point, Lake Superior		1,200,000	660,000
McCargoes Cove, Lake Superior		425,000	180,000
McLeods Channel, Lake Superior			1,020,000
Manistique, Lake Michigan		200,000	
Marquette, Lake Superior		625,000	
Mosley, Murry Lake		24,000	
Munising, Lake Superior		625,000	
Ontonagon, Lake Superior		625,000	
Paris, State fish commission	1,008,000		
Seven Mile Point, Lake Michigan		750,000	
Susie Island, Lake Superior		300,000	
Soo, State fish commission	2,000,000		
Tobins Harbor, Lake Superior		1,800,000	
Washington Harbor, Lake Superior		480,000	165,000
Whitefish Bay, Lake Superior		2,000,000	
Wrights Island, Lake Superior		912,000	280,500
Minnesota:			
French River, Lake Superior		500,000	
Grand Marais, Lake Superior		500,000	
Grand Portage, Lake Superior		600,000	
Knife River, Lake Superior		500,000	
St. Paul, State fish commission	250,000		
Standing Rock, Lake Superior		100,000	
Sucker River, Lake Superior		500,000	
Two Harbors, Lake Superior		500,000	
Montana:			
Bozeman, State fish commission			18,900
Twin Lake, south			4,500
New Jersey:			
Newfoundland, Green Pond		15,000	
New York:			
Amawalk, Amawalk Reservoir		10,000	
Bath, State fish commission	100,000		
Brewster, East Branch Reservoir		10,000	
Carmel, Boyds Corners Reservoir		10,000	
Lake Gilead		10,000	
Lake Gleneida		10,000	
Middle Branch Reservoir		10,000	
West Branch Reservoir		10,000	
Charity Shoals, Lake Ontario		214,152	
Croton Falls, Croton Falls Reservoir		10,000	
Croton Lake, New Croton Lake		10,000	
Dutch Point, Lake Ontario		614,789	
Fox Island, Lake Ontario		497,170	
Fuller Bay, Lake Ontario		399,238	
Grenadier Island, Lake Ontario		1,011,998	
Hopewell Junction, Sylvan Lake			15,000

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

LAKE TROUT—Continued.

Disposition.	Eggs.	Fry.	Finger-lings.
New York—Continued.			
Katonah, Cross River Reservoir		10,000	
Muscoot Reservoir		10,000	
Lake Placid, Lake Placid		25,000	
Long Lake West, Long Pond	25,000		
Mount Kisco, Byram Lake		10,000	
O'Neils Point, Lake Ontario		192,100	
Purdys Station, Titicus Reservoir		10,000	
Raquette Lake, Sagamore Lake	150,000		
Redwood, Millsite Lake		50,000	
Valhalla, Rye Lake		10,000	
Wilson Bay, Lake Ontario		468,724	
Ohio:			
Huron, Lake Erie		300,000	
Kelleys Island, Lake Erie		300,000	
Middle Bass Island, Lake Erie		261,000	
Oregon:			
Hood River, Ash Creek Pond			330
Pennsylvania:			
Pleasant Mount, State fish commission	100,000		
South Dakota:			
Fruitdale, Belle Fourche Reservoir			7,560
United States Reclamation Reservoir			9,450
Utah:			
Murray, State fish commission	50,000		
Vermont:			
Greensboro, Caspian Lake			15,000
Island Pond, Echo Pond		6,000	
Norton Mills, Big Averill Lake		10,000	
Roxbury, State fish commission	50,000		
Washington:			
Reardan, Spokane River			750
Tacoma, Spanaway Lake			330
Wisconsin:			
Ashland, Lake Superior			5,000
Bayfield, State fish commission	1,500,000		
Hayward, Grindstone Lake			20,000
Port Wing, Lake Superior		500,000	
Sand Island, Lake Superior		500,000	
Sheboygan, State fish commission	3,000,000		
State Line, Black Oak Lake			20,000
Sturgeon Bay, State fish commission	3,000,000		
Wyoming:			
Lander, Moccasin Lake			2,000
Total[a]	11,283,000	33,114,171	2,719,473

[a] Lost in transit, 51,000 fry and 16,250 fingerlings.

BROOK TROUT.

Disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Arizona:			
Globe, Workmen Creek			3,000
Prescott, Hassayampa River			7,000
California:			
East Auburn, American River, Middle Fork			4,000
Auburn Creek			4,000
Sisson, State fish commission	100,000		
Towle, American River, North Fork			4,000
Green Valley Creek			3,000
Truckee, Champion Pond	25,000		
Colorado:			
Arkansas Junction, Cattle Creek			5,000
Koch Lake			2,000
Aspen, Maroon Lake			20,000
Baileys, South Platte River, North Fork			5,000
Black Hawk, Dory Lake			4,000
Cebolla, Gunnison River			17,500
Cimarron, Van Place Lake			14,000

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

BROOK TROUT—Continued.

Disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Colorado—Continued.			
Cripple Creek, Longhungry Lake			4,000
Railway Streams			10,000
Crystal Lake, Crystal Lake			41,000
Curtin, Uneva Lake			9,000
Dawsons, South Platte River, North Fork			5,000
Divide, Dittemore's pond			1,000
Durango, Animas River and tributaries			5,000
Eagle, Brush Creek			35,000
Exgeria, Exgeria Creek			4,500
Ferndale, South Platte River, North Fork			5,000
Florence, Middle Creek			10,000
Frisco, Jay Bird Pond			4,000
Glenwood Springs, Eagle River and tributaries			20,000
Granby, Grand River, South Fork			5,000
Grand Junction, Berger Creek			3,000
Columbine Slough			4,000
Little Dolores Run			5,000
Gypsum, Brush Creek			5,000
Iola, Gunnison River			12,500
Kings, Rio Laido Creek			6,000
Lake City, Gunnison River, Lake Fork			15,000
San Crystabal Lake			16,000
Leadville, Arkansas River			20,000
Frying Pan River and tributaries			5,000
Horners Lake			3,000
Lower Lake Creek			20,000
Musgrove Lake		115,000	60,000
South Cottonwood Creek			15,000
Stotts Lake		5,000	
Tennessee River			20,000
Turquoise Lake			100,000
Upper Lake Creek			20,000
Willow Creek			3,000
Lyons, Rock Creek			5,000
Willow Creek			5,000
Mears Junction, Marshall Creek			6,000
Meredith, Jakeman Creek			5,000
Monson, Arnold's lake			5,000
Mosca, Stroup's pond			1,200
Musgrove, Musgrove Lake	250,000		
New Castle, Mitchell Lake			6,000
Nast, Frying Pan River			65,000
Ivanhoe Creek			5,000
Parshall, Spring Creek			3,000
Prospect, Lily Lake			7,500
Red Cliff, Mount Whitney Lake			4,000
South Homestead Lake			6,000
Rico, Silver Creek			6,000
Rifle, Hunters Gulch Pond			15,000
Ruedi, Frying Pan River			6,000
Rocky Fork Creek			5,000
Salida, Arkansas River			5,000
Arkansas River and tributaries			10,000
Tribble Park Lake			6,000
Sapinero, Gunnison River			20,000
Sargent, Tomichi River			10,000
Sellar, Sellar Lake			5,000
Shawnee, South Platte River, North Fork			5,000
Singleton, South Platte River, North Fork			5,000
Sloss, Frying Pan River			5,000
Steamboat Springs, Lambing Lake			5,000
Ranger Lake			5,000
South Lake			6,000
Thomasville, Engelbrecht Lakes			900,000
Frying Pan River			29,000
Lake Howard			10,000
Lime Creek			5,000
Spring Creek			4,000
Vasquez, Vasquez Creek			4,500
Victor, Bison Park Reservoir			5,000
Weston, Purgatory River, North Fork			10,000
Wheeler, Black Gore Creek			22,000
Black Lake			20,000
Whitewater, Kannah Creek, North Fork			4,000
Wellington Lake, Wellington Lake	150,000		
Yampa, South Derby Lake			10,000

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

BROOK TROUT—Continued.

Disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Connecticut:			
Bristol, Mine River		10,000	
Quinnipiack River, tributary of		15,000	
Burlington, Case Brook		8,000	
Punch Brook		10,000	
Cherry Brook Station, Cherry Brook		15,000	
East Haddam, Pine Brook		10,000	
Greenwich, Byram River, East Branch			200
Hartford, Dickinson Brook		30,000	
Hubbard Brook		9,500	
Meriden, Quinnipiack River			300
Middletown, Johnson Lane Brook			300
Plantsville, Clark's pond		8,000	
Dayton Brook		10,000	
Eight Mile River		10,000	
Judd Brook		10,000	
Simsbury, McLean's pond			3,000
Spring Pond			1,000
Tariffville, Muddy Brook		8,000	
Salmon Brook		20,000	
Salmon Brook, West Branch			3,000
Thompsonville, Buckhorn Brook		12,000	
Terry Brook		10,000	
Delaware:			
Claymont, Lackey's pond			100
Georgia:			
Blue Ridge, Harkins Creek			4,000
Noontootla Creek			5,000
Rock Creek			3,000
Clarksville, Ivy Branch			800
Santee Creek			800
Simmons Creek			1,600
Idaho:			
Addie, Round Prairie Creek			450
Ashton, Sadorus Pond			400
Hope, Livermore Lake			1,250
Leonia, Boulder Creek			450
Parma, Parma Creek			1,250
Roberts, Warm Spring Creek			200
Shoshone, Dewey Spring Lake			500
Indiana:			
La Porte, Rombaughs Creek		6,000	
Michigan City, Nasts Creek		10,000	
Trowbridges Creek		10,000	
Iowa:			
Bellevue, Mill Creek			1,200
Forestville, Spring Branch			5,000
Manchester, Spring Branch			5,000
North McGregor, Bloody Run			3,000
Maine:			
Augusta, Lake Cobbosseecontee			1,000
State fish commission	100,000		
Ayers Junction, Cathance Lake			1,000
Belfast, Dead Brook			1,990
Wescott Run			1,990
Biddeford, Davis Brook			4,000
Bigelow, Barnard Pond			12,000
Jim Pond			2,000
King & Bartlett Lake			2,000
Round Mountain Lake			2,000
Bingham, Chase Pond			2,850
Echo Pond			2,995
Lost Pond			500
Rowe Pond			2,000
Bodfish Crossing, Sunset Pond			500
Boothbay Harbor, Adams Pond			8,000
Meadow Cove Pond			8,000
Sawyers Pond			8,000
Bucksport, Craig Pond			1,000
Toddy Pond			1,000
Upper Patten Pond			1,000
Camden, Canaan Lake			3,980
Megunticook Lake			4,970
Carrabasset, Spring Lake			2,000
West Cherry Pond			2,000
Dedham, Green Lake			4,100
Phillips Lake		30,000	
Dennysville, Dennysville River			12,000

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

BROOK TROUT—Continued.

Disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Maine—Continued.			
East Orland, Craig Pond			8,216
Heart Pond			8,274
Ellsworth, Lower Patten Pond			1,000
Island Falls, Pleasant Pond			1,000
Jackman, Barrett Pond			8,000
Benjamin Pond			10,000
Bickford Pond			2,000
Bog Brook			4,000
Cold Stream Pond			2,000
Deer Pond			8,000
Fish Pond			2,000
Hale Pond			2,000
Heald Pond			2,000
Indian Pond			8,000
Jones Pond			2,000
Lake Wood			1,000
Luther Pond			2,000
Moose River			10,000
Mud Pond			10,000
Muskrat Pond			2,000
Round Pond			1,000
Sply Pond			1,000
Wood Pond			3,000
Kennebago, Grant Pond			2,925
Secret Pond			3,800
Kineo, Carry Brook			10,000
Socatean Brook			10,000
Spencer Pond			14,000
William Stream			2,000
Mapleton, Foss Brook			2,000
Presque Isle Creek, North Branch			600
Monmouth, Purgatory Pond			2,000
Sand Pond			2,000
North Ellsworth, Branch Pond		30,000	
Norway, Pennesawassee Lake			5,000
Virginia Lake			7,000
Oldtown, Sunkhaze Stream		10,500	
Onawa, Lake Onawa			14,000
Otis, Green Lake		5,000	
Patten, Davis Pond			10,000
Shin Pond			14,000
Poland, Lake Thompson			5,000
Portland, Beaver Brook			500
Brandy Brook			1,000
Cheney Brook			500
Duck Pond Brook			500
Eddy Brook and tributaries			475
Great Falls Brook			500
Harvey Brook			500
Little River, headwaters			1,000
Nonesuch River, headwaters			500
Quaker Brook			1,000
Red Brook			500
White Rock Brook			1,000
Presque Isle, Arnold Brook			500
East Branch			1,000
Echo Lake			500
Whites Brook			500
Rangeley, Gull Pond			26,000
Saco, Diamond Spring Brook			2,000
Hearn Brook			4,000
Kay Brook			2,000
Kimball Brook			5,025
Libby Brook			6,000
Stuart Brook			5,000
Sanbornville, Great East Lake			1,000
Sandy Point, Meadow Brook			1,000
Skinner, Barrett Pond			1,000
Bog Brook			500
Deer Pond			500
Indian Pond			500
South Paris, Allen Trout Pond			2,000
Back Pond			1,500
Hamlin Pond			1,500
Jewett Pond			1,500
Keewaydin Lake			18,000
Mud Bottom Pond			1.500

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

BROOK TROUT—Continued.

Disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Maine—Continued.			
South Paris, Pennesseewassee Lake			1,000
Weymouth Pond			1,500
Thorndike, St. Georges Lake			1,000
Wells Beach, Branch River, upper			1,000
West Paris, Abbott Pond			1,000
Concord River			1,000
Shagg Pond			1,000
Twenty Mile River			1,000
Washburn Pond			1,000
Winthrop, Lake Maranocook			16,000
Maryland:			
Annapolis Junction, Dorseys Branch			750
Baltimore, Cowans Branch			750
Hickory Run			750
Little Bens Run			750
North Run			1,200
Bradshaw, Young Spring Branch			450
Childs, Laurel Run			750
Deer Park, Altamont Springs Pond			600
Block Run			1,800
Deep Creek			600
Weitzells Run			600
Elk Ridge, Cascade Brook			450
Frankville, Crabtree Run			400
Good Hope, Squirrel Creek			3,000
Hagerstown, East Antietam Creek			1,550
Hydes, Gunpowder River, tributary of			300
Ilchester, Bonnie Branch			750
Knoxville, Little Catoctin Creek			1,200
Midland, Hunters Run			400
Mountain Lake Park, Gamel Run			500
Glade Run Pond			100
Oakland, Bear Creek, West Prong			1,200
Edgewood Pond			600
Elk Lick Run			2,000
Folly Run			2,000
Hoyes Run			300
McLean's pond			150
Meadow Mountain Run			300
Millers Run			600
Muddy Creek			1,200
Red Run			200
Salt Block Run			400
Snyder's pond			600
Wilsons Lake			150
Silver Springs, Little Paint Brook		23,790	
Swanton, Casselman Run			500
Cherry Creek			400
Crabtree Creek			1,800
Fawn Run			200
Glade Run			200
Laurel Run			300
Stony Run			200
Wilson, Crabtree Creek			1,800
Sand Run, South Prong			300
Massachusetts:			
Clinton, Felton Brook			200
Georgetown, Meadow Brook		5,000	
Greenfield, Stone Brook			200
Holyoke, Barrus Brook		10,000	
Goltsman's pond		2,000	
Leominster, Fall Brook			400
Line Brook			300
Lynn, Ceady Brook			200
Sandy Brook		10,000	
Medway, Spring Brook			400
New Bedford, Marys Pond		40,000	
Northampton, Mill River, East Branch			1,000
North Dana, Silver Brook		8,500	
Oakdale, Lake Quinsigamond			1,300
Quinapoxet River			600
Orange, Moose Horn Brook		10,000	
Palmer, Burleigh Brook		10,000	
Pittsfield, Secum Brook			400
Silver Hill, Silver Creek		20,000	
South Deerfield, Chard's pond			200

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

BROOK TROUT—Continued.

Disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Massachusetts—Continued.			
Tyngsboro, Carney's pond		10,000	
Westfield, Big Powder Mill Brook		15,000	
Black Brook		15,000	
Jacks Brook		15,000	
Little River		20,000	
Loomis Street Brook		15,000	
Manhan River		20,000	
Munns Brook		15,000	
Ponel Brook		10,000	
Potash Brook		15,000	
Sandy Mill Brook		10,000	
Taylor Brook		15,000	
Williamsburg, East Branch			300
Page Brook			300
Porter Brook			300
Stevens Brook			300
Westfield River			300
Willimansett, Willimansett Brook			200
Willimansett Pond			200
Michigan:			
Baldwin, Baldwin Creek		6,000	
Calumet, Eagle River			8,000
Clare, Chard Creek		10,000	
Five Lakes Creek		10,000	
Halstead Creek		10,000	
Henderson Creek		10,000	
Lowery Creek		10,000	
McEwen Creek		10,000	
McKinley Creek		10,000	
Moose Creek		10,000	
Number Four Creek		10,000	
Parrish Creek		10,000	
Pump House Creek		10,000	
Sanford Creek		10,000	
Tobacco River		15,000	
Tobacco River, Middle Branch		15,000	
East Tawas, Pickett Creek		12,000	
Vaughan Creek		12,000	
Gaylord, Au Sable River, North Branch		25,000	
Grayling, Tillula Lake		24,000	
Greenville, Hutchins Creek			3,000
Harriette, Slagle River		10,000	
Hillman, Brush Creek		14,400	
Gilchrist Creek		19,200	
Miller Creek		14,400	
Smith Creek		9,600	
Indian River, Pigeon River		28,800	
Iron River, Camp Lake Creek			2,000
Ishpeming, Black River			750
Escanaba River			750
Green Creek			750
Little Dead River			500
Schweitzer Creek			500
West Branch River			750
West Branch River, tributary of			750
Mandan, Mosquito Creek			500
White Birch River			500
Metamora, Hunters Creek, West Branch		10,000	
Newaygo, Bigelow Creek		20,000	
Cold Creek		15,000	
Penoyer Creek		20,000	
Nirvana, Sanborn Creek		5,000	
Pellston, Maple River		25,000	
Phoenix, Beaver Pond			500
Eagle River			500
Garden City Pond			750
Hills Creek			500
Jacobs Creek			500
Reed City, Hersey River		30,000	
Roscommon, Au Sable River, South Branch		29,400	
Rose Center, Buck Horn Creek		12,000	
Clarks Creek		10,000	
Saunders, Fowlers Lake			8,000
Saunders Creek			2,000
Wagners Creek			4,000
Standish, Peep River		14,700	

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

BROOK TROUT—Continued.

Disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Michigan—Continued.			
Thompsonville, Betsey River		13,000	
Tobins Harbor, Tobins Harbor			8,000
Wetmore, Big Indian River and branches			18,000
Wingleton, Pere Marquette River		50,000	
Minnesota:			
Brimson, Indian River			8,000
Buffalo, applicant		25,000	
Duluth, Lester River, branch of			4,000
Lake City, Fern Creek			400
Gilbert Creek			400
Millers Creek			400
Minnow Lake Creek			800
Wiers Creek			400
Lamoille, Riverside Ranch Creek			400
Thompsons Creek, South Branch			400
Red Wing, Belle Creek			800
Bullard Creek			800
Spring Creek			400
Wells Creek			600
Rochester, Zumbro Springs Pond			200
Waldo, Sargent Creek			6,000
Winona, Pine Creek			500
Rose Creek			250
Thompsons Creek			500
Thompsons Creek, South Branch			250
Wrenshall, Cloverdale Creek			4,000
Missouri:			
Exeter, Roaring River			1,000
South St. Joseph, State fish commission		50,000	
Montana:			
Belgrade, Benhart Creek			400
Bull Run Creek			400
Cowan Creek			400
East Gallatin Creek			400
Gibson Creek			400
Reese Creek			800
Ross Creek			400
Smith Creek			400
Spring Creek			400
Spring Hill Creek			400
Story Creek			400
Thompson Creek			2,025
Belton, Bowman Lake			7,500
Upper St. Marys Lake			7,500
Big Timber, Big Timber Creek			590
Otter Creek			500
Otter Creek, North Fork			625
Yellowstone River			600
Bozeman, Bear Creek, East Fork			2,000
Bear Creek, West Fork			1,200
Beaver Creek			4,200
Bozeman Creek			3,000
Brackett Creek			5,425
Buffalo Horn Creek			5,425
Cache Creek			1,200
Curtis Creek			3,000
Deer Creek			5,000
Dudley Creek			5,000
East Bear Creek			3,000
East Rainbow Lake			3,000
Meadow Creek			3,000
Moose Creek			3,000
North Dry Creek			3,000
Pine Creek			6,200
Porcupine Creek			5,000
Rockey Creek			5,000
Sage Creek			5,000
Sales Creek			3,000
South Taylor Creek			5,000
Squaw Creek			2,000
Stony Lake			5,000
Swan Creek			2,000
Taylor Creek, South Fork			2,000
Taylors Fork Creek			5,000
West Fork Creek, North Branch			7,000

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

BROOK TROUT—Continued.

Disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Montana—Continued.			
Bozeman, West Fork Creek, South Branch			5,000
West Rainbow Lake			5,000
Brisbin, Armstrong Creek			10,000
Columbus, East Rosebud Lake			500
Fishtail Creek			500
Little Yellowstone River			500
Lower Stillwater Creek			500
Red Lodge Creek			500
Rosebud River			500
Stillwater River			3,750
Trout Creek			500
West Rosebud Lake			500
Corwin Springs, Cutler Lake			800
Drummond, Trout Creek			1,250
Elliston, Trout Pond			300
Emigrant, Cottonwood Creek			5,000
Spring Creek			5,000
Strickland Creek			15,000
Essex, Dickey Creek			600
Fortine, Mountain Springs Lake			600
Gardner, Blacktail Creek			12,000
Glen Creek			8,000
Glacier Park, Lake McDonald			7,500
Haugan, St. Regis River			1,750
Havre, Beaver Lake			750
Clear Creek			750
Kalispell, Flathead River			625
Spring Creek			250
Stillwater River			375
Lewiston, Cottonwood Creek			1,200
Wolverine Creek			1,200
Livingston, Adair Creek			20,000
Armstrong Spring Creek			5,000
Holliday Spring Creek			5,000
Mortimor Spring Creek			5,000
Shields River			3,900
Yellowstone River			16,750
Manhattan, Gallatin River			1,125
Storey Creek			500
Martindale, Musselshell River, North Fork			1,000
Missoula, Bitter Root River			1,625
Bitter Root River, branch of			2,400
Blue Fork River			1,625
Burnt Fork Creek			4,800
Miller Creek			4,800
Petty Creek			4,800
Norris, Odell Creek			3,900
Parent Lake			5,000
Pony, North Willow Creek			15,000
South Willow Creek			20,000
Red Lodge, Upper Yellowstone River			1,600
Roberts, Tule Lake			750
Sixteen, Battle Creek			750
Somers, Loon Lake			375
Pend d'Oreille River			375
State fish commission	200,000		
Story Lake, Story Lake			1,200
Townsend, Crow Creek			1,875
Twodot, Big Elk Creek			1,375
White Sulphur Springs, Birch Creek			500
Newlan Creek			625
Sheep Creek			625
Smith River			825
Smith River, South Fork			600
Wilsall, Shields River			1,300
Yellowstone, Madison River, South Fork			400
Race's pond			400
Nebraska:			
Chadron, Bordeaux Creek			50,000
Little Bordeau Creek			25,000
Spring Creek			8,000
Nevada:			
Leadville, Truckee River and tributaries	50,000		
New Hampshire:			
Bartlett, Saco River		59,000	3,500
Berlin, Jerico Brook			1,500

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

BROOK TROUT—Continued.

Disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
New Hampshire—Continued.			
Bristol, Dickermans Brook		5,000	
Claremont, Red Water Brook		15,000	
Cold River, Cold River			400
Concord, Crowley's pond		15,000	
Little Pond			400
One Stock Brook			200
Stark Brook			200
White Rock Brook			200
Converse, Big Brook			300
Dover, Jackson's pond		3,000	
Elmwood, Moose Brook			200
Fabyans, Abenaki Brook		2,000	
Ammonoosuc River		10,000	
Asquam Brook		2,000	
Bear Brook		4,000	
Clinton Brook		2,000	
Crawford Brook		4,000	
Deception Brook		2,000	
Jefferson Brook		3,000	
Lake Anderson		2,000	
Lake Carolyn		10,000	
Mount Echo Brook		2,000	
Sebossis Brook		2,000	
Twin Rivers		2,000	
Franklin, Call Brook		15,000	
Putney Brook		10,000	
Grafton, Brown Brook		10,000	
Stockwell Brook		10,000	
Grasmere, Harry Brook			200
Greenfield, Hardy Brook		13,750	
Joslin Brook		13,750	
Lowe Brook		13,750	
Mountain Brook		13,750	
Railroad Brook			200
Greenland, Experimental ponds		1,000	
Greenville, Richardson Brook			200
Hanover, Mink Brook and tributaries			2,500
Keene, White Brook			300
Laconia, State fish commission	75,000		
Lebanon, Mascoma River		30,000	
Manchester, Bowman Brook			100
Dearborn Brook			200
Menter Brook			200
Nigger Brook			100
Milford, Osgood Brook			200
Pulpit Brook			200
Seasar Brook			200
Trow Brook			100
Nashua, Bartemus Brook		5,000	100
Brick Yard Brook			200
Glover Brook			100
Naticook Brook		20,000	
Pegleg Brook		5,000	
North Walpole, Adams Brook			200
Great Brook			400
Percy, Christine Lake			800
Peterboro, Bogle Brook			200
Dunbar Brook			200
Town Line Brook			200
Wallace Brook			300
Raymond, Fordway Brook			100
Rumney, Glen Ponds			400
South Brookline, Wallace Brook			200
Sunapee, Stony Brook			100
Walpole, Upper Cold River		40,000	
Williams Brook			200
Warner, French Brook			200
Osgood Brook			200
Silver Brook			200
Stevens Brook			200
Wilton, Blood Brook			200
County Farm Brook			200
Hickey Brook			100
Hodkins Brook		15,000	
New Jersey:			
Allendale, Saddle River, tributary			1,200
Andover, Pequest River, headwaters			1,000

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

BROOK TROUT—Continued.

Disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
New Jersey—Continued.			
Bernardsville, Olcott Brook			100
Oliver Brook			100
Pickle Brook			100
Pyne Brook			400
Raritan River, headwaters			400
Rood Brook			400
Maywood, Van Sauns Pond			1,800
Paterson, Little Round Pond			100
Saw Mill Pond			500
Yahn's pond			2,100
Pequannock, Saw Mill Brook			1,800
Rahway, Spring Brook			1,800
River Edge, Coles Brook			1,200
West Nutley, Rusby's pond			100
New Mexico:			
Carrizozo, Rio Ruidoso River			3,000
Cimarron, Cimarron River			2,500
Eureka River			2,500
Glorieta, Holy Ghost Creek			5,500
Indian Creek			2,500
Lower Pecos River			3,000
Macho Creek			2,500
Pecos River			5,000
Ponchuello Creek			5,500
Las Vegas, Rio de la Caga			6,500
Rio Pueblo, North Fork			2,000
Rio del Pueblo, South Fork			3,000
Rito de la Junta			3,000
Rito de las Lunas			4,000
Raton, Sugarite River			7,500
Roswell, Arroyo Seco Creek			3,000
Santa Fe, Nambe River			5,000
Santa Fe River			5,000
Tesque River			3,500
Ute Park, Big Clear Creek			2,500
Wagon Mound, Tyson Spring Creek			500
Vermijo Creek			500
New York:			
Afton, Bump Creek		10,000	
Kelsey Creek		10,000	
Albany, Ten Eyck's pond			2,000
Altmar, Hilton Brook		5,000	
Orwell Brook		10,000	
Pekin Creek		10,000	
Potter Creek		10,000	
Apulia, Butternut Creek		20,000	
French Brook		5,000	
Garrett Brook		5,000	
Hotaling Brook			300
Hiscock Brook			300
June Brook			300
Kennellys Brook			200
Range Brook		5,000	
Scammal Brook		10,000	
Smiths Brook			200
Ardsley, Sawmill River		20,000	
Arkville, Huckleberry Brook			1,500
Plattekill Creek			2,000
Ashokan, Bushkill Creek			1,000
Beaver River, Beaver River			3,800
Bellina, Abells Brook			200
Bellina Brook			300
Benson Mines, Black Creek		10,000	
Ellis Creek		10,000	
Little River		25,000	
Tamarack Creek		15,000	
Twin Lake, Upper			500
Big Indian, Big Indian Creek			1,000
Neversink Creek, East Branch			1,500
Neversink Creek, West Branch			1,000
Binghamton, Choconut Creek			2,100
Hillcrest Pond			600
Thomas Brook			2,400
Trout Creek			2,400
Cambridge, Coulters Brook			3,000
Duel Hollow Brook			1,000
Lowries Brook			1,000

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

BROOK TROUT—Continued.

Disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
New York—Continued.			
Cambridge, Pomnanook Brook			3,000
Rices Brook			1,500
Croghan, Beaver River		50,000	
Davenport Center, Charlotte River		20,000	
Middlebrook Creek		10,000	
Dunraven, Delaware River East Branch			800
Huckleberry Brook			100
Ellenville, Chestnut Creek			1,000
Rondout Creek, East Branch			1,000
Vernoy Kill Creek			1,500
Erieville, Erieville Brook			100
Feura Bush, Onesquethaw Creek			2,000
Forestport, Little Woodhull Creek			500
Georgetown, Chenango Brook			300
Greenwich Junction, Hartshorn Creek			330
Hancock, Cadosia Creek			1,200
Gee Brook			1,200
Oliver Creek			1,200
Reads Creek			1,200
Sand Creek			1,200
Harrisville, Big Hill Pond			300
Hopewell Junction, Wortlekill Creek		8,000	
Hornell, Canisteo River		20,000	
Lime Kiln Creek		20,000	
Keeneys, Delaware River, East Branch			400
Meadow Brook			200
Kenwood, Spring Pond		5,000	
Kerhonkson, Mill Brook			1,500
La Fargeville, Catfish Creek		10,000	
Lake Mahopac, West Branch		10,000	
Lake Placid, Au Sable River		25,000	
Chub River		25,000	
Warren Pond			800
Lanesville, Stony Clove Creek			1,000
Liverpool, Bloody Brook			200
Sawmill Brook			200
Long Lake, Bear Pond			500
Millbrook, Howard's pond			2,000
Shunpike Brook			4,000
Monroe, Islesmere Lake			400
Montgomery, Beaver Dam Run			200
Mount Pleasant, Beaverkill Creek			1,500
Newark, Military Run		10,000	
New City, Thornfield Brook			200
New York City, New York Aquarium	5,000		
Onativia, Cascade Brook		15,000	
Downing Brook		5,000	
Morgan Brook		5,000	
Oneonta, Anderson Brook		10,000	
Baker Brook		6,000	
Charlotte Creek		15,000	
Elk Creek		15,000	
Harrison Brook			1,000
Horton Creek			1,500
Hotaling Hollow Creek		6,000	
Houck Brook		6,000	
Knapp Brook		5,000	
Otego Creek and tributaries		20,000	
Otsdawa Creek		20,000	
Ouleout Creek		15,000	
Ouleout Creek, Upper		15,000	
Second Brook		5,000	
Third Brook		5,000	
Patterson, Cowl Brook		5,000	
Mountain Brook		5,000	
Phoenicia, Woodland Creek			1,000
Piercefield, Catamount Lake		25,000	
Pine Bush, Veerkeerdeerkill Creek			2,200
Port Henry, Birch Pond		9,000	
Club House Brook		3,000	
Club House Pond		3,000	
Finch Pond		3,000	
Lower Moss Pond		3,000	
Schroon River		14,000	
Schroon River, above dam		3,000	
Upper Moss Pond		3,000	

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

BROOK TROUT—Continued.

Disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
New York—Continued.			
Port Jervis, Bushkill Brook			1,200
Mongaup River			2,400
Stringkill Brook			1,200
Poughquag, Pleasant Ridge Brook		5,000	
Rome, Fish Creek		30,000	
Pringle Brook		20,000	
Roaring Brook			800
St. Johnsville, Big Sprite Creek		15,000	
Salem, White Creek			1,500
Schenevus, Elk Creek		10,000	
Shandaken, Bushnellsville Creek			1,000
Sherburne, Buell Brook		5,000	
Dark Hollow Brook		5,000	
Four Corner Brook		8,000	
Great Brook		15,000	
Handsome Brook		20,000	
Nigger Hollow Brook		5,000	
Number Six Brook		8,000	
Shawlee Brook		10,000	
Swamp Brook		5,000	
Westcott Brook		5,000	
Willy Brook		5,000	
Syracuse, Beartrap Creek			300
Canaseraga Creek			300
Carpenter Brook		10,000	
Cedarville Creek		10,000	
Collins Brook			200
Elmwood Brook			100
Geddes Brook			300
Mont Frede Creek		15,000	
Peck Brook		5,000	200
Pools Brook			300
Rockwell Brook		5,000	
Swamp Brook			200
Tupper Lake, Wards Brook			1,500
Walden, Kootin Creek			3,600
Ten Brook			300
Wallace, Wessels Creek			1,200
Watertown, Deerlick Creek		10,000	
Drakes Creek		10,000	
Felts Mills Creek		30,000	
French Creek		10,000	
Johnsons Branch		20,000	
Kings Creek		10,000	
Wayland, Canaseraga Creek		50,000	
Willsboro, Hadley Brook			834
Little Sky Pond			834
Rabbe Brook			832
North Carolina:			
Addie, Scotts Creek, North Fork			7,000
Altapass, Rose Creek			5,000
Brevard, Bethwood Lake			250
Bobs Bear Creek			250
Carsons Creek			225
Conners Creek, Upper			225
Glade Creek			225
Hogshead Creek			150
Horsehead Creek			250
Nicholsons Creek			250
Crestmont, Big Creek			5,000
Elk Park, Buckeye Creek			4,000
Dutch Creek			4,000
Elk River			5,000
Elk River, West Fork			5,000
Grays Creek			4,000
Hanging Rock Creek			5,000
Horsebottom Creek			3,000
Laurel Creek			5,000
Methodist Creek			3,000
Graphiteville, Davidson Creek			450
Hickory, Potts Creek, branch of			225
Linville River, Linville River			14,400
Montezuma, Chestnut Heights Lake			2,000
Grandmother Creek			3,000
Kawana Lake			6,000
Linville River			4,000
Toe River			10,000
Toe River, East Fork			3,000

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

BROOK TROUT—Continued.

Disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
North Carolina—Continued.			
Oak Park, Shoal Creek			10,000
Old Fort, Greasy Creek			225
Silica, Duckworth Creek			300
Sylva, Dodgin Creek			6,000
White Rock Creek			5,000
Tryon, Weatherby Creek			800
North Dakota:			
Dickinson, Spring Creek			1,000
Ohio:			
Bellefontaine, Mad River and tributaries		10,000	
Rush Creek		10,000	
Butler, Laney's pond		5,000	
Chagrin Falls, McFarland Brook		9,000	
Mansfield, Butler Creek			400
Flemings Creek			400
Wiles Run			780
Wolfe Creek			300
Millersburg, Doughty Creek		12,000	
Martin Creek		10,000	
Paint Creek		12,000	
Salt Creek		10,000	
Plymouth, Quarry Lake		5,000	
Urbana, East Spring Run		10,000	
Oregon:			
Bonneville, State fish commission	250,000		
Brownsville, Callipooia Creek			5,000
Carson, Wind River, Falls Fork			1,200
Glendale, Windy Creek			3,800
Klamath Falls, applicant	100,000		
Lebanon, Santiam River			5,200
Milwaukee, Day's pond			4,000
Pennsylvania:			
Allenwood, Spring Creek			2,400
Ansonia, Kettle Creek			2,400
Lyman Run			2,400
Pine Creek, West Branch			2,400
Ashland, Buckhorn Creek			3,000
Dyers Run			2,000
Austin, Bark Shanty Run			1,600
Big Nelson Run			1,600
East Cowley Run			1,600
East Deering Run			1,600
East Fork Run			1,600
Fishing Creek			1,600
Freeman Run			1,600
Heath Run			1,600
Jacobs Run			1,600
Jones Run			1,600
Little Moores Run			1,600
Moores Run			1,600
Prouty Run			1,600
South Woods Run			1,600
West Deering Run			1,600
West Freeman Run			1,600
Bainbridge, Hoffman Run			2,000
Bean Run, Bean Run			1,800
Beth Run			1,800
Bowmans Creek			3,000
Cherry Creek			1,800
Cider Run			1,800
Meadow Run			1,800
Bear Creek, Pond Creek			2,400
Bedford, Cove Creek			2,000
Shovers Run			4,000
Bellefonte, Spring Creek			5,500
Benton, Fishing Creek			2,400
Bradford, Buck Lick Run			1,000
Bump Run			1,000
Chapple Fork Creek			2,000
Fuller Brook			1,000
Hemlock Run			1,000
Lewis Run			2,000
Lynn Valley Creek			2,000
Minard Run			2,000
Nelson Run			1,000
Oil Valley Creek			1,000
Pine Run			1,000

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

BROOK TROUT—Continued.

Disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Pennsylvania—Continued.			
Bradford, Sugar Run, North Fork			2,000
Sugar Run, South Fork			2,000
Tuna Creek			2,000
Tuna Creek, West Branch of North Fork			2,000
Tuna Creek, West Branch of South Fork			2,000
Turnip Run			2,000
Willow Creek			2,000
Bushkill, Indian Ladder Creek			300
Cameron, Hunts Run			300
Hunts Run, McKinnon Branch			300
Hunts Run, Steam Mill Branch			200
Carlisle, Green Spring Creek			3,000
Letort Run			3,000
Lutz Run			2,000
Yellow Breeches Creek			3,000
Central, Fishing Creek			2,400
Chambersburg, Falling Spring Run			3,000
Christiana, Cat Tail Run			2,000
Johnsons Run			2,000
Cisna Run, Bryners Run			2,000
Clarks Summit, Leggitts Creek			200
Clay Rock, Mountain Creek			3,000
Clearfield, Anderson Creek			200
Alexs Branch			100
Ames Run			100
Antis Creek			100
Bear Run			100
Beaver Creek			100
Birch Creek			100
Black Run			100
Blooms Run			100
Browns Run			100
Carrs Creek			100
Chestnut Run			100
Cold Creek			200
Cooper Run			200
Cripple Run			100
Crists Run			100
Crooked Run			100
Crystal Run			100
Curry Run			200
DeBeck Branch			100
Dixons Run			100
Doctors Fork Run			100
Duneling Creek			100
Elder Run			100
Elk Run			100
Forked Run			100
Hammond Creek			100
Harpster Run			100
Hartshorn Run			100
Hazelett Run			200
Hoovers Creek			100
Horn Creek			100
Hubler Creek			100
Irwins Branch			100
Johnson Run			100
Kline Branch			100
Laurel Run			200
Lick Run			200
Little Anderson Run			100
Little Montgomery Run			100
McFadden Run			100
McGeorge Run			100
McPherson Run			100
Marsh Run			100
Mauk Run			100
Mitchell Run			100
Montgomery Creek			200
Moore Run			100
Moose Creek			200
Morgan Run			100
Packer Run			100
Panther Run			100
Pine Run			100
Pitch Pine Run			100
Poplar Run			100

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

BROOK TROUT—Continued.

Disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Pennsylvania—Continued.			
Clearfield, Rattlesnake Run			100
Roberts Run			100
Rocky Creek			175
Rodgers Creek			200
Sanders Creek			200
Sandy Run			200
Squirrel Creek			200
Stone Run			200
Stoney Run			200
Stonehammer Creek			200
Surveyor Run			200
Timber Creek			200
Tomes Run			200
Torrey Run			200
Trout Run			200
Tucker Run			200
Two-Mile Run			200
Walnut Creek			200
Walnut Run			200
Watson Run			200
Woods Run			200
Cold Springs, Schrader Creek			8,000
Crandalltown, Pleasant Creek			5,606
Cresco, Bear Creek			2,000
Boyer Run			2,000
Broadhead Creek			2,000
Broadhead Creek, Lewis Branch			2,000
Broadhead Creek, Middle Branch			2,000
Cranberry Creek			2,000
Goose Pond Run			2,000
Mills Creek			2,000
Rattlesnake Run			2,000
Spring Run			2,000
Spruce Cabin Run			2,000
Stoney Run			2,000
Curry, Three Spring Run			2,000
Dauphin, Stony Creek			2,400
Denver, Leeds Run, Upper			2,000
Stony Run			2,000
Downingtown, Broad Run			2,000
Drehersville, Millers Creek			2,000
Driftwood, Mix Run			5,000
Mix Run, Little Fork			3,000
Page Run			3,000
Red Run			4,000
Sander Run			3,000
Easton, Bushkill Creek			5,000
Emporium, Clear Creek			3,000
Cowley Run			2,000
Deep Creek			3,000
Elk Creek			3,000
Elk Creek, Driftwood Branch			3,000
Fishing Creek			3,000
Four-Mile Run			3,000
North Creek			3,000
Parker Run			2,000
Portage Creek			3,000
Ephrata, Trout Run			2,000
Fishing Creek Station, Fishing Creek and tributaries			3,000
Florin, Big Spring Run			1,000
Forge Run, Black Moshannon Creek			2,400
Forge Run			2,400
Frazer, Ridley Creek			4,000
Valley Creek, tributary of			2,000
Gap, Livingstone Run			2,000
Slaymakertown Run			2,000
Glen Eyre, Tar Kiln Creek			1,200
Grays Station, Grays Run			2,400
Hamburg, Blue Mountain Pond			200
Irish Creek			4,000
Pine Creek			6,000
Shomos Pond			4,000
Hazleton, Beck Pond			2,000
McMurtrie-Beck Run			2,000
Panther Run			2,000
Hiawatha, Shehawken Creek			1,200

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

BROOK TROUT—Continued.

Disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Pennsylvania—Continued.			
Hoadleys, Gravity Run			1,200
Middle Creek			2,400
Wangum Creek			1,500
Honesdale, Dyberry Creek			300
Dyberry Creek, West Branch			300
Johnson Creek			300
Log Cabin Run			300
Hughesville, Trout Pond Run			1,600
Jamison City, Fishing Creek			1,800
Jersey Shore, Catfish Run			1,600
Heyd Run			1,600
Larrys Creek, First Fork			1,600
McElhattan Creek			2,400
McMurens Run			2,400
Johnstown, Bens Creek			1,000
Bens Creek, North Fork			2,000
Bens Creek, South Fork			3,000
Blue Hole Run			300
Brush Creek			1,300
Card Machine Run			1,000
Clear Shade Creek			2,000
Cranberry Glade Creek			1,300
Club Run			2,000
Dalton Run			2,000
Dark Shade Creek			2,000
Drakes Run			300
Elk Lick Creek			1,300
Fishing Run			300
Flaugherty Creek			1,000
Grays Run			1,300
Henaaries Creek			2,000
Hills Creek			1,300
Hoozer Run			200
John Run			200
Jones Run			300
Kellers Run			200
Laurel Creek			1,300
Laurel Run No. 1			2,000
Laurel Run No. 2			1,300
Lick Run			2,000
Little Conemaugh River, South Fork			2,000
Mill Creek			2,000
Millers Run			2,200
Mill Stone Creek			2,000
Negro Glade Run			1,000
Pickings Run			2,000
Pine Run			1,000
Piney Run			2,000
Powder Mill Run			2,000
Quemahoning Creek, North Fork			2,000
Roaring Run			2,000
Runnells Mill Run			300
Salt Lick Creek			2,000
Shaffer Run			300
Shannon Run			2,000
Solomons Run			2,000
Stuart Run			2,000
Town Line Run			300
Tub Mill Creek			2,000
Upper Dark Shade Creek			2,000
Whites Creek			1,000
Kinzers, Londondale Run			2,000
Kutztown, Sacony Creek			4,000
Lancaster, Baumgarden Run			2,000
Evans Run			2,000
Fruitville Brook			2,000
Rush Run			2,000
Larrys Creek, Larrys Creek			1,600
Long Run			1,600
Mash Run			1,600
Roaring Run			1,600
Spook Hollow Run			1,600
Lackawaxen, Greeley Lake			2,400
Lebanon, Bachman Creek			3,000
Indiantown Creek			3,000
Manada Creek			3,000

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

BROOK TROUT—Continued.

Disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Pennsylvania—Continued.			
Lebanon, Rattling Run			3,000
St. Josephs Creek			3,000
Lehighton, Strauss Valley Creek			5,000
Lemont, Buffalo Run			3,000
Cedar Creek			2,000
Center Furnace Run			2,000
Laurel Run			3,000
Shingletown Gap Run			2,000
Sinking Creek			3,000
Spring Creek			3,000
Stone Creek			3,000
Leslie Run, Leslie Run			700
Shaffers Run			200
Lewistown Junction, Alfarata Stream			300
Lingle Run			3,000
New Lancaster Valley Creek			3,000
Treaster Valley Creek			3,000
Ligonier, Mill Creek and tributaries			400
Lititz, Hess Run			2,000
Rudys Run			2,000
Lock Haven, Bull Run			200
Cedar Run			200
Chathams Run			200
Cherry Run			200
Duck Run			200
Fishing Creek			300
McCalls Ferry, Muddy Run			3,000
Marietta, Clarks Run			5,000
Donegal Creek			7,000
Evans Run			5,000
Kraybills Creek			5,000
Martinsburg, Clover Creek			4,000
Mauch Chunk, Mud Run			500
Mercersburg, Buchanans Run			2,000
Dickeys Run			2,000
Milford, Sawkill Creek			3,000
Minersville, Indiantown Run			200
Little Swatara Creek			300
Montoursville, Little Bear Creek			1,200
Mooresburg, Beaver Run			200
Mount Union, Carmichaels Branch			3,000
Carters Run			2,400
Licking Creek			3,000
Old Womans Run			2,000
Scrub Gap Creek			2,000
Singers Gap Creek			3,000
Narvon, Shirks Run			1,200
New Germantown, Huston Run			2,000
New Philadelphia, Lewistown Run			200
Silver Creek			200
Stines Pond			100
Tumbling Run, Upper			200
New Providence, Factory Run			4,000
Newton Hamilton, Licking Creek			4,000
Newville, Laurel Run			3,000
Norwich, Havens Brook			200
Indian Run			200
Potato Creek			300
Orangeville, Fishing Creek, branch of			600
Orviston, Big Hayes Run			800
Big Run			800
Big Run, West Branch			800
Little Hayes Run			800
Marsh Creek			1,600
Three Rock Run			800
Two Runs			1,600
Peale, Basin Run			200
Benner Run			200
Black Moshannon Creek			400
Meyers Run			100
Rock Run			200
Sandy Run			300
Penfield, Laurel Run			3,300
Mountain Run			2,000
North Brook			2,000

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

BROOK TROUT—Continued.

Disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Pennnsylvania—Continued.			
Philadelphia, Fairmont Park Aquarium			50
Punxsutawney, Curry Run			3,000
Hazlett Run			3,000
Quarryville, Blackburns Run			2,000
Octoraro Creek			2,000
Stewarts Creek			2,000
Ralston, Abbott Run			100
Acid Branch			200
Battle Run			100
Bear Trap Run			100
Bevier Run			100
Buck Run			100
Frozen Run			200
Heylmun Run			100
Hounds Run			100
Long Run			200
Miners Run			100
Pidgeon Run			100
Pleasant Stream			200
Potash Run			100
Red Run, Left Branch			100
Roaring Branch Creek			200
Rock Run			200
Rock Run, Left Branch			200
Rock Run, Right Branch			200
Salt Run			200
Short Run			100
Slack Run			200
Sugar Run			200
Winslows Gut Run			100
Yellow Dog Run			100
Reading, Cacoosing Creek			2,200
Ritters Run			10,200
Spring Run			200
Willow Creek			400
Reedsville, Coopers Gap Creek			400
Honey Creek			400
Kishacoquillas Creek, West Branch			400
Tea Creek			400
Reinholds Station, Swamp Creek			2,000
Retort, Bear Run			1,000
Beaver Run			1,000
Geerhart Brook			1,000
Mountain Brook			2,000
Tom Tit Run			2,000
Trout Run			2,000
Richmond, Little Aughwick Creek			4,000
Rockport, Indian Run			200
Rapps Creek			200
Rowland, Middle Creek			400
St. Clair, Paradise Pond			100
Sheridan, Sheridan Springs Pond			2,400
Short Run, Pleasant Creek			3,200
Sinnemahoning, Wykoff Run			4,000
Slate Run, Baldwin Creek			1,600
Bunnell Run			1,600
County Line Creek			1,600
Frances Branch			1,600
Lebo Creek			1,600
Little Slate Run			1,600
Morris Run			1,600
Navel Run			1,600
Red Run			1,600
Slate Run			1,600
Slate Run, Cushman Fork			1,600
Slate Run, Manor Fork			1,600
Somerset, Ankeny Creek			4,300
Beam Run			2,000
Brough Run			1,800
Clear Run			1,800
Deeters Run			2,100
Jones Mill Run			2,000
Kooser Run			2,000
Laurel Hill Creek, headwaters			1,800
Lohr Creek			1,800
North Fork Run			200

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

BROOK TROUT—Continued.

Disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Pennsylvania—Continued.			
Somerset, Quemahoning Creek, North Fork			5,400
Shaffer Run			2,000
Sonestown, Eagles Mere Lake, tributary			300
Lewis Creek			400
Macie Run			300
Spring City, Johnsons Run			200
Stony Creek, headwaters			200
Spring Grove, Myers's pond			1,000
Myers's pond No. 2			1,000
Stillwater, Fishing Creek			3,000
Stroudsburg, Baker Run			2,000
Broadhead Creek			2,000
Hagermans Run			2,000
Lee Run			2,000
Marshalls Creek			2,000
Michaels Creek			2,000
Pencil Creek			3,000
Reeders Creek			2,000
Spragle Run			1,000
Stony Creek			2,000
Wigwam Run			2,000
Strawbridge, Big Muncy Creek			4,000
Summerhill, Roaring Run			300
Tamaqua, Cold Run			3,000
Monongahela Creek			10,000
Wildcat Run			3,000
Thompson, West Preston Pond			600
Tionesta, Bates Run			800
Big Coon Creek			1,600
Blocker Run			800
Council Run			800
Davis Run			800
Dawson Run			800
Dice Run			800
Holeman Run			800
Hunter Run			800
Jamison Run			800
Johns Run			800
Jug Handle Run			800
Korb Run			800
Little Coon Run			800
Little Hickory Creek			800
Little Tionesta Creek			800
McCarthy Run			800
Pigeon Run			800
Piney Run			800
Posie Field Run			800
Recks Run			800
Ross Run			800
Sibble Run			800
Stuarts Run			1,600
Sugar Camp Run			800
Tubbs Run			1,600
Vockroth Run			800
Tobyhanna, Frame Cabin Creek			2,000
Pollys Run			2,000
Tobyhanna Creek			3,000
Towanda, Millstone Creek			3,000
Schrader Branch			3,000
Unionville, Benners Run			300
Wallace Run			300
Ursina, Blue Lake			1,500
Buck Run			1,500
Clay Run			1,500
Fall Run			1,500
Harbaugh Run			1,500
Laurel Hill Creek			1,500
Laurel Run			3,000
Muddy Creek			1,500
Sandy Run			1,500
Vicksburg, Beaver Run and tributaries			100
Waterville, Lower Pine Bottom Run			1,600
Otter Run			1,600
Otter Run and branches			1,600
Waynesboro, East Antietam Creek			12,000
Funk Creek			1,000
Mackey Run			2,000
Red Run			3,000

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

BROOK TROUT—Continued.

Disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Pennsylvania—Continued.			
West Chester, Bradford Pond			4,000
Browns Brook			150
Oakland Pond			125
West Hawley, Dyberry Creek, East Branch			1,800
Westtown, Chester Creek, tributary			300
Wilcox, Big Wolf Run			3,000
Clarion Creek			3,000
Johnson Run			3,000
Oil Creek			2,000
Paine Run			2,000
Rocky Run			3,000
Williamsburg, Cedar Brook			2,000
Williamsport, Mosquito Creek			200
Scotch Mill Creek			1,200
Sugar Camp Run			1,200
Windber, Beaverdam Creek			1,000
Berkey River			1,000
Berkebile River			1,000
Big Brent Run			1,000
Biscuit Spring Run			500
Bobs Creek			1,000
Bowser Run			1,000
Coal Run			1,000
Conemaugh River, South Fork			1,000
Cub Run			1,000
Elton Run			1,000
Gloss Run			1,000
Juniata River, North Branch			1,000
Laurel Run			1,000
Laytons Run			1,000
Little Dark Shade Creek			1,000
Little Paint Creek			1,000
Manger Run			1,000
Mangus Run			500
Miller Run			1,000
Oldham Run			1,000
Otter Creek			1,000
Paint Creek			1,000
Ripple Run			500
Shingle Run			1,000
Sienna Run			1,000
Turkey Run			1,000
Wentze Run			1,000
Wheeler Run			1,000
Winterburn, Baker Run			1,600
Woodbine, Bells Hollow Branch			750
Boyds Run			750
Neils Hole Branch			750
Watsons Branch			750
York, Bear Run			200
Youngdale, Big Spring Run			1,600
Johnsons Run			1,600
Little Spring Run			1,600
Lucas Run			800
McElhattan Run			1,600
McKague Run			1,600
Matter Run			1,600
Mill Run			800
Minsner Run			1,600
Spruce Run			800
South Carolina:			
Greenville, Gap Creek			1,600
Mathis Creek			2,400
Oil Camp Creek			1,600
Slicker Creek			1,600
South Dakota:			
Bakerville, Lame Johnie Creek, North Fork			20,000
Big Bend, Prairie Creek			1,000
Burke, Hay Creek			4,000
Englewood, Whitewood Creek			15,000
Hermosa, Battle Creek			2,500
Hill City, Upper Spring Creek			4,000
Interior, American Horse Lake			24,500
Ludlow, Little Nasty Creek			400
Maurice, Lost Cabin Creek			8,000
Mystic, Deer Creek			7,000

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

BROOK TROUT—Continued.

Disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
South Dakota—Continued.			
Nahant, Tilson Creek			2,000
Pactola, Long's pond			2,500
Rapid Creek			6,000
Rapid City, Barker's pond			10,000
Lime Creek			10,000
Platts Pond			5,000
Rapid Creek			40,000
Rochford, Box Elder Creek			2,000
Rapid Creek, South Fork			2,500
Spring Creek			40,000
Rosebud, Rosebud Creek, East Branch			15,000
Savoy, Big Spearfish Creek			28,000
Little Spearfish Creek			2,000
Silver City, Rapid Creek			6,000
Spearfish, Chicken Creek			10,000
Crow Creek			20,000
Franklin Run			8,000
Higens Gulch Creek			10,000
Kissock's pound			5,000
Nichols Spring Branch			5,000
Schmidt's lake			5,000
Smiths Spring Branch			5,000
Spearfish Creek			25,000
Watercress Creek			1,000
Willow Creek			10,000
Sturgis, Warren Creek Pond			10,000
Winner, Silver Lake			4,000
Tennessee:			
Adams, Red River			11,200
Crandull, Birch Branch			2,000
Fagall Branch			2,000
Elkmont, Jakes Creek			15,000
Johnson City, Wofford Lake			375
Livingston, Nettle Carrier Creek			3,000
Mosheim, Blue Springs Pond			1,500
Peryear, Clear Creek			8,000
Springfield, Beaverdam Creek			6,000
Sulphur Fork Creek			8,000
Wartrace Creek			8,000
Utah:			
Hyrum, Clear Spring Pond			1,500
Morris Station, Mill Pond			5,000
Murray, State fish commission	175,000		
Vermont:			
Arlington, Battenkill River		25,000	
Beaver Meadow Brook		4,000	
Benedict Brook		4,000	
Cold Brook		4,000	
Deming Brook		3,000	
Fayville Brook		12,000	
Green River		12,000	
Hopper Brook		3,000	
Roaring Branch, South Fork		4,000	
Tidd Hollow Brook		4,000	
Warm Brook		4,000	
Whitman Brook		4,000	
Barnett, Aiken Brook			4,000
East Peacham Brook			5,000
Harvey Brook			2,500
Barton, May Brook			2,500
Roaring Brook			2,000
Bellows Falls, Athens Brook		8,000	
Bundy Brook		5,000	
Saxtons River		20,000	
Weston Brook		5,000	
Williams River		20,000	
Bennington, Basin Brook		3,000	
Beaver Meadow Brook		4,000	
Bickford Hollow Brook		4,000	
Broad Brook		6,000	
Bushnell Brook		3,000	
Chase Brook		3,000	
Chase Brook No. 2		3,000	
Dewey Brook		4,000	
Evans Brook		3,000	
Hell Hollow Brook			8,500

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

BROOK TROUT—Continued.

Disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Vermont—Continued.			
Bennington, Little Pond Brook		4,000	
Lyman Lot Brook		3,000	
Mill Brook		3,000	
Rake Branch		8,000	
Redfield Brook		6,000	
Reservoir Brook		3,000	
Rider Brook		3,000	
Roaring Branch		4,000	
Rockwood Brook		6,000	
Stratton Brook		3,000	
Waters Brook		3,000	
Bethel, Silver Lake		30,000	
Brandon, Arnold Brook			2,000
Mill River		15,000	
Canaan, Big Averill Lake			20,000
Hegan Creek		25,000	
Little Averill Lake		30,000	
Derby Line, Beaver Pond			20,000
Holland Pond			25,000
East Dorset, Battenkill River, headwaters		25,000	
Mad Tom Brook		6,000	
East Putney, Slab Hollow Brook		15,000	
Edgewater, Niggerhead Brook		4,000	
Groton, Darling Pond		25,000	37,500
Wells River, North Branch		8,000	
Hardwick, Cooper Brook			2,000
Lamoille River			5,000
Paine Brook			3,000
Porter Brook			3,000
Tucker Brook			2,000
Holden, Clover Vale Brook		10,000	
Furnace Brook			3,000
Furnace Brook, West Branch		10,000	
Phillips Brook			1,000
Sugar Hollow Brook		25,000	1,000
Island Pond, Baldwin Brook		5,000	
Castonguay Brook		8,000	
Cold Spring Brook		5,000	
Daloff Brook		8,000	
Ferrin River		15,000	
Guappe Brook		6,000	
Howard Brook		8,000	
Kennedy Brook		8,000	
Langer Brook		10,000	
Lightening Brook		4,000	
Lost Brook		6,000	
McCabe Brook		4,000	
Mill Brook		6,000	
Motley Brook		10,000	
North Branch		15,000	
Nulhegan River		15,000	
Oswegatchie Creek		4,000	
Paye Brook		4,000	
Rosebrook Brook		8,000	
Rowe Brook		4,000	
Smith Brook		8,000	
Spring House Brook		8,000	
Stott Brook		10,000	
Lyndon, Fred Houghton Brook		6,000	
Fred Smith Brook		6,000	
Gilbert Brook		5,000	
Hawkins Brook		10,000	
Sheldon Brook		5,000	
South Wheelock Brook		15,000	
Manchester, Battenkill River		30,000	
Battenkill River, West Branch		20,000	
Bourn Brook		12,000	
Bourn Brook, North Branch		6,000	
Mattawee River		30,000	
Marshfield, Cedar Swamp Brook		4,000	
Joe Mears Brook		4,000	
Lowrie Brook		8,000	
Malby Brook		4,000	
Molly Falls Brook		8,000	
Middlesex, Long Brook		8,000	
Montpelier, Herrick Brook		4,000	
Mallory Brook		5,000	

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

BROOK TROUT—Continued.

Disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Vermont—Continued.			
Montpelier, Shady Rill Brook		4,000	
Verge Pond			1,000
Morrisville, Bedell Brook			3,000
Campbell Brook			3,000
Curry Pond		4,000	
Small Brook			1,500
Newport, Bowley Brook			1,500
Burgoine Brook			2,500
Estey Brook			1,500
Mill Brook			2,500
Miller Brook			4,000
Mosher Brook			2,500
Norton Mills, Forest Brook			5,000
Forest Brook, Black Branch			2,500
Forest Lake			25.500
Roaring Brook			2,500
Norwich, Lake Mitchell		50,000	
Orleans, Barton River and tributaries			2,780
Dewey Brook		4,000	
Dutton Brook		4,000	
Gallup Brook		5,000	
Long Pond			20,000
Willoughby Lake		40,000	
Willoughby River and tributaries		25,000	3,500
Plainfield, Carr Brook		3,000	
Poultney Poultney River,			1,000
Randolph, Halfway Brook		10,000	
Tager Brook		8,000	
Rutland, White River, Middle Branch		25,000	
Chittenden Reservoir		20,000	2,000
Cold River, North Branch		8,000	
Cold River, South Branch		8,000	
St. Johnsbury, Adams Brook		5,000	
Bacon Brook		8,000	
Blodgetts Brook		4,000	2,000
Cliffords Brook		10,000	
Cold Brook		5,000	
Frog Pond			1,000
Gage Brook			5,500
Harveys Pond		15,000	
Hastings Brook		8,000	
Hawkins Brook			5,500
Houghton Brook			12,500
Joyce Brook		5,000	
Lawrence Brook		5,000	
Lawrence Pond		5,000	
Meadow Brook			1,000
Niles Brook		8,000	
North Brook		5,000	1,500
Pierce Brook		5,000	
Pope Brook		15,000	
Roberts Brook		5,000	
Shattucks Brook		5,000	
Shaw Brook		5,000	
Sleepers River		20,000	
Spalding Brook		8,000	
State fish commission			7,600
Tafts Brook			4,000
Walter Andric Brook		10,000	
Wards Brook		5,000	
Watermans Brook		5,000	
Wells Brook		5,000	
Wright Brook			2,500
Sharon, Lake Mitchell		50,000	
South Royalton, Alco Pond		15,000	
East Hill Brook		3,000	
South Ryegate, Long Pond		30,000	
Sunderland, Battenkill River		25,000	
Lathrop Brook		3,000	
Lye Brook		6,000	
Mill Brook		4,000	
Tanner Brook		3,000	
Sutton, Bundy Brook		8,000	
Reed Brook		5,000	
Twombly Brook		5,000	
Willard Brook		5,000	

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

BROOK TROUT—Continued.

Disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Vermont—Continued.			
Taftsville, Babcock Creek			600
Beaver Brook			600
Skunk Hollow Brook			500
Walden, Rogers Pond			500
West Burke, Beaver Brook		3,000	
Clark Brook		15,000	
Eaden Brook		15,000	
West Hartford, Jericho Brook		10,000	
Porter Brook		8,000	
Sunny Brook		3,000	
Tiger Town Brook		10,000	
Wilmington, Cold Brook and tributaries		15,000	
Johnson Brook			1,000
Lime Kiln Brook			1,000
Woodstock, Kedron River			500
Lakota Lake			3,000
Smith Brook			1,000
Virginia:			
Afton, Mulloys Creek			3,000
Big Island, North Otter Creek			2,800
Boones Mill, Roaring Run			600
Callaghan, Cave Run			600
Clifton Forge, Smith Creek			7,500
Coeburn, David's pond			1,000
Elkton, North River			500
Fort Blackmore, Stony Creek			3,000
Fries, Peach Bottom Creek			2,500
Galax, Chestnut Creek			2,000
Harrisonburg, Dry River			3,000
Hot Springs, Jackson River			1,000
Island Ford, Big Run			500
Lexington, Hottinger's pond			3,000
Longdale, Simpson Creek			650
Lovettsville, Dutchman Run			700
Millboro, Dry Run			750
McClung Creek			750
Montvale, Dogans Creek			200
Staunton, Cow Pasture River			600
Crab Run			1,000
Ramseys Run			1,000
Waterlick, Little Passage Creek			1,200
Washington:			
Alice Creek, Snoqualmie River, South Fork			2,700
Colville, applicant	100,000		
Ostrander, Clearwater Creek			400
St. Helens Lake			400
Palouse, Palouse River			450
Port Angeles, Cassalery Creek			2,000
Seattle, Stickney Lake			450
Snoqualmie, applicant	50,000		
South Bend, Black Lake			3,000
Spokane, Newman Lake			450
Stanwood, Lake Martha			450
Vancouver, State fish commission	100,000		
West Virginia:			
Barnum, Pine Swamp Run			540
Beverly, Beaver Creek			360
Burner, Club House Run			400
Little River			590
Clay Run, Clay Run			540
Elkwater Run			360
Clover Lick, Clover Creek, branch of			500
Coalton, Flat Bush Creek			540
Elkins, Cross Run			3,000
Isner Creek, Laurel Branch			3,000
Hancock, Glen Brook			1,800
Seldom Seen Brook			1,800
Harrison, Days Creek			500
Kanawha, Cedar Pond			200
Keyser, Graysons Run			500
Mill Run			500
Marlinton, Swago Creek			4,000
Midvale, Pleasant Run			450
Stone Coal Run			540
Parsons, Mill Run			540
Pennsboro, Scott's lake			540

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

BROOK TROUT—Continued.

Disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
West Virginia—Continued.			
Petersburg, Grant Run			360
Thorn Brook			540
Richwood, Cherry River and tributaries			4,000
Cherry River, South Fork			2,800
Gauley River			4,000
Ronceverte, Turkey Creek			600
Schell, Potomac River, North Fork			4,000
Terra Alta, Horse Shoe Run			1,800
Rhine Lake			400
Snow Creek, North Fork			500
Snow Creek, South Fork			300
Thunderstruck Run			1,800
Winterburn, Greenbrier River, headwaters			5,000
Wisconsin:			
Alma, Johns Creek			500
Little Waumandee Creek			1,800
Little Waumandee, upper end			1,250
Mill Creek			500
Trout Creek			500
Wolf Creek			250
Ashland, Cedar Creek			500
Fish Creek			750
Marengo Creek			750
Pine Creek			500
Whittlesey Creek			500
Ashland Junction, Cedar Creek			3,000
Fish Creek			3,000
Whittlesey Creek			2,000
Athelstane, Meadow Creek			500
Augusta, Bear Grass Creek			4,000
Russell Creek			4,000
Bakers Spur, Peshtigo River			1,000
Popple River, South Branch			1,000
Bangor, Adams Valley Creek			400
Burns Creek, Lower			200
Burns Creek, Upper			400
Draper Creek			200
Sand Creek			600
Schroeder Creek			200
Swift Creek			200
Barneveld, Harrison Creek			500
Lanpop Run			250
Moyer Creek			500
O'Neil Creek			500
Park Creek			500
Smith Creek			1,000
Trout Creek			500
Barron, Miller Creek			1,000
Bayfield, Reefer Creek			8,000
Birnamwood, Embarrass River, Middle Branch			600
Black River Falls, Town Creek			600
Brule, Brule River			16,000
Casco Junction, Kewaunee River			500
Chippewa Falls, Cushing Creek			2,000
Main Creek			600
Spring Creek			3,000
Swans Creek			600
Crandon, Peshtigo River, South Branch			750
Dalton, Bellfountain Creek			400
Dalton Creek			200
Lawson Creek			200
De Pere, Oneida Spring Creek			250
Dodgeville, Breman Stream			200
Coxes Branch			200
Harkers Branch			200
Jones Branch			250
Jones Creek			250
Wedlake Stream			250
Donaldson, Goose Lake			900
Drummond, Fletcher Creek			3,000
Lost Creek			3,000
Durand, Cherry Creek			400
Cranberry Creek			400
Fall Creek			400
Plum Creek			400
Schatz Creek			200
Schue Creek			200

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

BROOK TROUT—Continued.

Disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Wisconsin—Continued.			
Eau Claire, Alder Creek			200
Balsam Creek			200
Beaver Creek, North Fork			200
Deen Creek			200
Graham Creek			200
Hansens Creek			200
Jackson Creek			200
Little Rock Creek			200
Louis Creek			200
Nine Mile Creek			200
North Creek			200
Pine Creek			200
Rock Creek			200
Sandy Creek			200
Sherman Creek			400
Spring Creek			200
Stone Creek			200
Thorson Creek			200
Trout Creek			200
Wrights Creek			200
Edgerton, Greens Creek			250
Millers Creek			200
Noes Spring Brook			200
Eland Junction, Embarrass River, branch of			300
Elkhorn, Spring Prairie Brook			450
Whitewater Lake Brook			450
Williams Bay Brook			450
Elmwood, Little Mosourie Creek			750
Porter Creek			500
Elroy, Brewer Creek			400
Mile Creek			400
Fountain City, Eagle Valley Creek and tributaries			2,250
Foxboro, Black River			8,000
Grandview, Eighteen Mile Creek			3,000
Long Lake Branch			3,000
Hatley, Plover River			900
Warder Brook			300
Hawkins, Burgess Creek			250
Deer Creek			187
Deer Creek, North Fork			187
Deer Creek, South Fork			188
Grass Brook			300
Main Creek			787
Meadow Brook			300
Pine Creek			488
St. Clair Creek			300
Stony Brook			600
Trout Brook			188
Hayward, Nemakagon River			10,000
Spring Lake Creek			4,000
Williams Lake			8,000
Hillsboro, Cancutt Creek			200
Dalton Creek			200
Silver Creek			200
Slater Creek			200
Sunbeam Creek			200
Warner Creek			200
Warner Creek, headwaters			200
Warner Creek, North Branch			200
Independence, Bennett Creek			1,600
Borst Valley Creek			1,400
Burt Creek			400
Cooks Creek			400
Dubiel Creek			400
Engum Creek			400
Farrs Creek			400
Gundersons Creek			400
Hauge Creek			400
Hawkenson Creek			400
Husselgaard Valley Creek			400
Jergen Olsons Creek			400
Johnsons Creek			400
Kurths Creek			400
Lygas (G) Creek			400
Lygas (I) Creek			400
Nelson Creek			400

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

BROOK TROUT—Continued.

Disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Wisconsin—Continued.			
Independence, Papes Creek			400
Plumb Creek			400
Roskos Creek			400
Russells Valley Creek			400
Ruste Creek			400
Schaffners Creek			400
Simonson Creek			400
Slanten Creek			400
Solfest Creek			400
Traverse Creek			1,200
Ulberg Creek			400
Utes Creek			400
Veun Creek			800
Zimmers Creek			400
Ingram, Main Creek, Middle Branch			250
Main Creek, North Fork			250
Main Creek, South Fork			250
Kendall, Davis Creek			400
Pollock Creek			200
Stade Creek			200
La Crosse, Bohemian Valley Creek			500
Bostwick Valley Creek			500
Chipmunk Coulee Creek, North Branch			250
Chipmunk Coulee Creek, South Branch			250
Faas Creek			167
Fishback Creek			250
Gills Coulee Creek			250
Halfway Creek			500
Halfway Creek, North Branch			250
Halfway Creek, South Branch			250
Lansen Coulee Creek			250
Morman Coulee Creek			500
Morman Coulee Creek, Freehoffs Branch			167
Norman Creek and tributaries			1,800
Sand Lake Coulee Creek			250
Sand Lake Coulee Creek, North Branch			250
Spring Coulee Creek			1,200
Waumandee Creek and tributaries			4,500
Weikers Creek			166
Leon, Leon Creek			400
Long Lake, Popple River			1,000
Lyndhurst, Bud Pond			250
Gardner Creek			500
Marx Creek			250
Mill Creek			750
Moon Lake			250
Parker Pond			250
Red River			1,000
Red River, West Branch			750
Red Springs Creek			250
Richland Creek			250
Manitowoc, Francis Creek			500
Krinwaneks Creek			500
Marengo, Brunsweiler River			2,500
Deer Creek			2,500
Little Whittlesey Creek			2,500
Marengo River			2,500
Millers Creek			2,500
Spring Brook			2,500
Trout Brook			2,500
Warner Creek			2,500
Mauston, Haskins Creek			200
Mile Creek			200
Mile Creek, Wells Branch			200
Riders Creek			200
Seven Mile Creek			200
Tildeman Creek			200
Mellen, Brunsweiler River			750
Cedar Creek			500
Devils Creek			750
Little Montreal Creek			450
Little Montreal Creek, No. 2			750
Little Montreal Creek, No. 3			750
Montreal Creek			750
Menomonie, Anderson Creek			100
Annis Creek			100
Balsbaugh Creek			100

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

BROOK TROUT—Continued.

Disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Wisconsin—Continued.			
Menomonie, Beaver Creek			100
Big Elk Creek			150
Big Hay Creek			100
Big Meadow Creek			100
Bishop Creek			100
Biss Creek			100
Bolan Creek			100
Clacks Creek			100
Coon Creek			100
Cowan Creek			100
Cranberry Creek			100
Denning Creek			100
Drowley Creek			100
Dushane Creek			100
Eau Galle Creek			100
Eddy Creek			100
Eighteen Mile Creek			100
Fall Creek			100
Galloway Creek			100
Gilbert Creek			100
Hay River			200
Hay River, South Fork			100
Home Farm Run			100
Iron Creek			100
Irvine Creek			100
Johns Creek			100
Kings Creek			100
Knights Creek			100
Knipple Creek			100
La Forge Creek			100
Lambs Creek			100
Lambs Creek, North Fork			100
Little Beaver Run			100
Little Elk Creek			100
Little Hay Creek			100
Little Missouri River			100
Little Otter Creek			100
Little Sand Creek			100
Losbys Run			100
Louis Creek			100
Lower Pine Creek			100
Lynch Creek			100
McCarthy Creek			100
Missouri River			100
Mud Creek			100
Palmers Run			100
Paradise Creek			100
Parker Run			100
Popple Creek			100
Roach Creek			100
Rock Creek			100
Rush Creek			100
Sand Creek			100
Shafer Creek			100
Simonsen Creek			100
Sinking Creek			100
Sly Creek			100
Smith Creek			100
Spring Creek			100
Stony Creek			100
Thum Creek			100
Tiffany Creek			100
Trout Creek			100
Upper Pine Creek			200
Varney Creek			100
Webber Creek			100
White Creek			100
Wilcox Creek			100
Wilson Creek			200
Wilson Creek, North Branch			100
Wolf Run			100
Merrillan, Cisna Creek			1,000
Gearing Creek			800
Hall Creek			1,200
Hensel Creek			600
Mound Creek			600
Olson Creek			600

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

BROOK TROUT—Continued.

Disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Wisconsin—Continued.			
Merrillan, Stockwell Creek			1,000
Van Herset Creek			600
Visneau Creek			600
Millston, Butterfuss Creek			800
Gross Creek			600
Mondovi, Brown Creek			200
Brunet Valley Creek			200
Carroll Creek			200
Coon Creek			200
Cranberry Creek			200
Day Creek			200
Dover Creek			200
Dutch Creek			200
Flute Creek			200
Ford Creek			600
Furgason Creek			200
Hakes Creek			200
Harvey Creek			200
Lee Valley Creek			200
MacDonough Creek			200
Merrit Creek			200
Modena Creek			200
Rock Creek			200
Rossman Creek			200
Van Pelt Creek			200
Whelan Creek			400
Wilson Creek			200
Moquah, Cochrans Creek			3,000
Pine Creek			4,000
Radys Creek			3,000
Mount Horeb, Black Earth Stream			500
Erbe Creek			500
German Valley Creek			750
Lake Park Creek			500
Mount Vernon Creek			500
Sand Rock Valley Creek			750
Tasher Stream			500
New Lisbon, Kenners Creek			400
Kilmers Creek			200
Macomber Creek			400
Meads Creek			400
Northcutt Creek			400
Richards Creek			400
Rosland Creek			400
Serrurier Creek			200
Velvic Creek			400
White Creek			400
Norwalk, Devils Hollow Creek			400
Moores Creek			400
Oak Grove Creek			400
Sybold Creek			200
Oconomowoc, Rosenow Creek			400
Spring Creek			400
Parrish, Prairie River			1,250
Phelps, Big Twin Creek			500
Hay Meadow Creek			500
Plymouth, Spring Creek			800
Prentice, Jump River			750
Nelson Creek			500
Nyberg Creek			500
Radisson, King Creek			500
Stanley Creek			500
Readstown, Abbey Creek			200
Anderson Creek			200
Black Bottom Creek			400
Clancey Creek			200
Day Creek			200
Duddle Creek			200
Elk Creek			200
Harris Branch			200
Harrison Run			200
Johnson Creek			200
Norwegian Hollow Creek			200
Trout Creek			200

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

BROOK TROUT—Continued.

Disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Wisconsin—Continued.			
Rice Lake, Anderson Creek			1,500
Angler Creek			1,500
Barker Creek			1,500
Beaury Creek			1,500
Big Bear Creek			1,500
Big Spring Creek			1,500
Browns Creek			1,500
Champion Creek			1,500
Cobb Creek			1,500
Cranberry Creek			1,500
Desair Creek			1,500
Devils Creek			1,500
East Branch			1,500
Germain Creek			1,500
Hay Creek			1,500
Hemlock Creek			1,500
Hickey Creek			1,500
Kettle Creek			1,500
Lawler Creek			1,500
Little Bear Creek			1,500
Little Tuscobia Creek			1,500
Long Creek			1,500
Lost Creek			1,500
Meadow Creek			1,500
Merritts Creek			1,500
Miller Creek			1,500
Moen Creek			1,500
Moosier Creek			1,500
Mud Creek			1,500
Nail Creek			1,500
Overby Creek			1,500
Pekagama Creek			1,500
Pepper Creek			1,500
Pine Creek			1,500
Renville Creek			1,500
Rice Creek			1,500
Rock Creek			1,500
Savage Creek			1,500
Silver Creek			1,500
Spoon Creek			1,500
Spring Creek			1,500
Spruce Creek			1,500
Spur Nine Creek			1,500
Sucker Creek			1,500
Swan Creek			1,500
Tainter Creek			1,500
Thirty Three Creek			1,500
Tuscobia Creek			1,500
Weirgor Creek			1,000
Yellow River			1,000
Richland Center, Brush Creek			750
Fancy Creek			1,050
Little Willow Creek			600
Melanchton Creek and tributaries			400
Mill Creek, East Branch			600
Souls Creek			750
Ridgeway, Love Creek			375
Russell Creek			375
Sheboygan Falls, Mitchell Creek			500
Silver Creek			750
Solon Springs, Leo Creek			4,000
Soperton, Oconto Creek, North Branch			500
Sparta, Ash Run			3,200
Bailey Creek			200
Beaver Creek			3,400
Big Creek			3,400
La Crosse River			4,000
Leverich Creek			200
Little Silver Creek			200
Prescott Creek			2,000
Robinson Creek			400
Rockwell Creek			3,000
Sias Creek			3,000
Silver Creek			4,400
Smith Creek			400
Soper Creek			4,200
Sparta Creek			3,000

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

BROOK TROUT—Continued.

Disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Wisconsin—Continued.			
Sparta, Squaw Creek			4,200
Swamp Creek			200
Tar Creek			400
Walruth Creek			400
Walworth Creek			4,000
West Creek			2,000
Spring Brook, Bean Creek			600
Stanberry, Chipenazy Creek			6,000
Stone Lake, Sissabagama Creek			4,000
Tomah, Bear Creek			3,000
Brandy Creek			3,000
Cole Creek			3,000
Council Creek			3,000
Deer Creek			3,000
Dixon Creek			3,000
Jennings Creek			3,000
La Crosse River			4,000
La Fleur Creek			3,000
Mud Creek			3,000
Mill Creek			3,000
Prairie Creek			3,000
Silver Creek			3,000
Sparta Creek			3,000
Swamp Creek			3,000
Tar Creek			3,000
Warrens, Brandy Creek			400
Fish Creek			800
Mill Creek			800
Myers Creek			800
Sand Creek			800
Second Creek			800
Town Creek			600
Waukesha, Moores Creek			400
Wolf Creek			400
Westby, Aanes Spring Creek			200
Coon River, East Branch			200
Coon River, North Branch			200
Nap Creek			200
Nordlie Springs Creek			200
Lease Creek			200
Shreve Spring Creek			200
Socum Spring Creek			200
Whitehall, Adams Creek			800
Bear Creek			1,200
Borst Creek			800
Breed Creek			400
Carpenter Creek			800
Caswell Creek			400
Conrow Creek			400
Cook Creek			400
Curran Creek			800
Duck Creek			800
East Valley Creek			800
Farr Creek			800
Freeman Creek			400
Hagen Creek			800
Harenden Creek			400
Harlow Creek			400
Haugey Creek			400
Hensel Creek			400
Idema Creek			400
Kidder Creek			400
Lake Creek			400
Lebakken Creek			400
Little Elk Creek			800
Little Plum Creek			400
McKivergan Creek			400
Melton Creek			1,000
Norsk Creek			400
North Elm Creek			800
Pike Creek			400
Sleepy Hollow Creek			400
Solsrud Creek			400
South Creek			400
Taylor Creek			400
Torgerson Creek			400
Torson Creek			800

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

BROOK TROUT—Continued.

Disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Wisconsin—Continued.			
Whitehall, Trump Coulee Creek			400
Vold Creek			1,200
Warner Creek			400
Webb Creek			400
Wells Creek			400
Willow Creek			800
Wood Creek			400
Wilton, Cook Creek			200
Dorset Creek			200
Farmers Creek			200
Hibbard Creek			200
Hillyer Creek			200
Kickapoo River, headwaters			200
Posey Creek			200
Slater Creek			200
Walze Creek			200
Winne-Boujou, Bay Lake			6,000
Brule River			16,000
Cutler Creek			4,000
Harts Creek			16,000
Little Brule River			4,000
Lucius Lake			4,000
McDougal Lake			6,000
Nebagamon River			6,000
Holcomb and Fox Creeks			3,450
Wyoming:			
Aladdin, Little Beaver River			1,500
Beulah, Boylans Spring Branch			5,000
Crystal Brook			10,000
Sand Creek			1,500
Cody, Big Horn River, South Fork			250
Bobcat Creek			250
Boulder Creek			250
Chain of Lakes			250
Crandall Creek and tributaries			250
Eagle Creek			250
Eagle Creek, Upper			250
Elk Creek			250
Fish Hawk Creek			250
Ishawoa Creek			250
Shoshone River, Middle Fork			250
Shoshone River, North Fork			250
South Fork River			250
Elk Mountain, Austins Creek			1,000
Big Qualey Lake			3,000
Dickensons Lake			2,500
Doling Creek			1,000
Fish Creek			1,500
Foot Creek			1,500
Hadsel Creek			2,000
Jack Creek			1,000
Kerr Creek			1,000
Little Pass Creek			2,500
Medicine Bow River			4,000
Medicine Bow River, West Fork			1,500
Mill Creek			1,500
Mule Creek			1,500
Pass Creek			4,000
Potato Creek			1,500
Turpin Creek			2,000
Wagon Hound Creek			6,000
Wagon Hound Creek, East Fork			1,500
Farrell, Deer Creek			10,000
Fort Steele, North Platte River			2,500
Pass Creek			3,000
Rattlesnake Creek			2,500
Hanna, East Qualey Lake			450
Medicine Bow River			6,000
Medicine Bow River, East Fork			450
Rattlesnake Creek			725
Spring Creek			450
Stillwater Creek			450
West Qualey Lake			450
Lander, Glacier Lake			29,700
North Fork Lake			30,000
Popo Agie River			58,000
Washakie Lake			30,000

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

BROOK TROUT—Continued.

Disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Wyoming—Continued.			
Laramie, Soldier Creek			10,000
Rock River, Rock River			6,000
Saratoga, North Platte River			4,000
Sheridan, Owl Creek Pond			600
State fish commission	250,000		
Sundance, Beaver Creek			25,000
Beaver Creek, headwaters			15,000
Lytle Creek			20,000
Maloney's pond			5,000
Miller Creek, North Fork			20,000
Red Water Creek			10,000
Sundance Creek			15,000
Sundance Creek Pond			1,000
Togues Spring Creek			8,000
White Tail Creek			15,000
Thermopolis, Owl Creek			750
Worland, Deep Creek			900
Lee Creek			750
Otter Creek			750
Spring Creek			750
Ten Sleep Creek			1,800
Total [a]	2,055,000	4,128,290	5,891,033

[a] Lost in transit, 18,500 fry and 9,105 fingerlings.

SMELT.

Disposition.	Eggs.	Fry.	Adults.
Connecticut:			
Winsted, Highland Lake		1,000,000	
Maine:			
Green Lake, Green Lake		3,775,000	
Maryland:			
Antietam, Potomac River			9,400
Michigan:			
Big Bay, applicant	2,000,000		
Sault Ste. Marie, State fish commission	5,000,000		
New York:			
Port Henry, Lake Champlain		1,000,000	
Long Lake West, Little Tupper Lake	2,400,000		
Total	9,400,000	5,775,000	9,400

GRAYLING.

Disposition.	Eggs.	Fry.
Colorado:		
Loveland, Big Thompson River, North Fork		45,000
Michigan:		
Lovells, Au Sable River, North Branch		48,000
Paris, State fish commission	50,000	
Montana:		
Belgrade, East Gallatin Creek		35,000
Belton, Lake Louise		50,000
Butte, applicant	100,000	
Ennis, Madison River		165,000
Total	150,000	343,000

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

CRAPPIE AND STRAWBERRY BASS.

Disposition.	Fingerlings.
Arkansas:	
Alma, Thieme's pond	100
Conway, McCulloch's pond	150
Corning, Corning Lake	300
Dollar Junction, Towns's pond	100
Emerson, Stevens's pond	100
Heber Springs, Little Red River	300
Lake Village, Lake Chicot	500
Magnolia, Baker's pond	100
Shirey's pond	200
Stevens's pond	100
Wyrick's pond	200
Mammoth Spring, Warm Fork Creek	200
Menasha, Menasha Lake	400
Millville, Freeman Smith Pond	300
Ozan, Fletcher's pond	100
Pindall, Deer Lick Pond	100
Pine Bluff, Pine Pond	200
Rogers, Silver Lake	200
Sheridan, Vanlandingham's pond	200
Shirley, Little Red River, Archey's fork	400
Tokio, McLarty's pond	200
Colorado:	
Loveland, Southside Lake	300
Connecticut:	
Mystic, Long Pond	200
District of Columbia:	
Washington, Rock Creek	400
Twin Lakes	800
Illinois:	
Belleville, Gilmore Lake	600
Hartman, Hay & Reis Mill Pond	200
Benton, Hamilton's lake	160
Popes Lake	160
Carbondale, Ayer's pond	200
England Lake	200
Hundleys Lake	200
Waddington Lake	200
Coulterville, Lane's pond	200
McGraw's pond	200
Galesburg, Soangetaha Club Pond	300
Hillsboro, Fishing Club Pond	200
South Pond	200
Hinsdale, Salt Creek	600
Marshall, Crystal Lake	160
Meredosia, Mississippi River	500
Red Bud, Rehmer's pond	200
Red Bud Lake	400
Papenburg Lake	200
Indiana:	
Cedar Lake, Cedar Lake	215
Marion, Mississinewa River	175
Muncie, Orchard Home Pond	35
Vincennes, Wabash Lake	105
Iowa:	
Albia, Albia City Lake	990
Bellevue, Mississippi River	93,000
Keokuk, Mississippi River	250
Manchester, Maquoketa River	1,400
North McGregor, Mississippi River	85,900
Riceville, Little Cedar River	200
Valley Junction, Elbert Lake	200
Kansas:	
Abilene, Meadow Pond	35
Baileyville, Horseshoe Pond	300
Calista, Jones's pond	35
Concordia, Berk's pond	35
Garnett, Cedar Creek	200
Goodland, Smoky Hill River, North Fork	35
Hillsdale, Bull Creek	100
Holton, Rafter's upper pond	150
Huron, Anthony's pond	300
Independence, Elk River	100
Kansas City, Hosp's pond	35
Kingman, Home Park Pond	200
Kansas—Continued.	
Lenexa, Lake Killarney	105
Mound City, Shale Pit Pond	100
Olathe, Hatfield's pond	70
Van Tries's pond	35
Osawatomie, Hospital Pond	100
Paola, Bull Creek	200
Peabody, Gray's pond	105
Country Club Lake	105
Stockton, Book's pond	35
Wakeeney, Trego Creek	35
Welda, Welda Reservoir	200
Kentucky:	
Bank Lick, Emerald Lake	35
Berea, Early's pond	35
Brighton, Clark's pond	35
Buckner, Clore's pond	35
Campbellsburg, Smith's pond	70
Taylor's pond	35
Woods's pond	35
Crab Orchard, Dix River	70
Crescent Springs, Villa Madonna Lake	35
Erlanger, Rector's pond	35
Tanner's pond	35
Foster, Dietz's pond	35
Franklin, Butt's pond	70
Georgetown, Bell Pond	35
Hall's pond	35
Lewis's pond	35
Moore's pond	35
Saunders's pond	35
Towles's pond	35
Glasgow, Dean's pond	35
Glencoe, Green Farm Lake	35
Heidelberg, Kentucky River	175
Hodgenville, Wheeler's pond	70
Wright's pond	35
Jackson, Kentucky River	105
Johnson, Park Lake	140
La Grange, Fisher's pond	35
Harrods Creek	105
Highland Lake	140
Snowden's pond	35
Lawrenceburg, Kentucky River	105
Lexington, Bosworth's pond	35
Bowyer's pond	35
Country Club Lake	70
Drake's pond	35
Featherstone's pond	35
Featherstone's pond No. 2	35
Fisher's pond	35
Green Hill Pond	35
Lake Ellerslie No. 3	105
Cemetery Lake	35
Louisville, Lake Lansdowne	105
Wooldridge's pond	35
Morningview, Garner's pond	53
Nazareth, Trinity Lake	70
Oil City, Beaver Creek	35
Olmstead, Whippoorwill Creek	105
Paris, Bedford Pond	35
Harrods Creek	35
New Pond	35
Tarr's pond	35
Richmond, Cocoanut Pond	35
Lake Reba	105
Sparta, Montague's pond	35
Winchester, Basket Pond	35
Betts's pond	35
Brookwood Pond	35
Daniel's pond	35
Donaldson's pond	35
Eagles Nest Pond	35
Ecton Pond	35
Fitch's pond	35
Fox's pond	35
Gaitskill's pond	35
Garner's pond	35
Gordon's pond	35

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

CRAPPIE AND STRAWBERRY BASS—Continued.

Disposition.	Fingerlings.
Kentucky—Continued.	
Winchester, Hampton's pond	35
Hampton's mill pond	35
Harris's pond	35
Holmes's pond	35
Howard Lower Creek	70
Hunt's pond	35
Ice Company Pond	35
Jeffries's pond	35
Johnson's pond	35
Jones's lake	35
Lake Attersall	140
Miller Lake	70
Powell's pond	35
Prewitt's pond	70
Quisenberry Pond	35
Railroad Pond	35
Redman's pond	35
Robinson's pond	35
Stoner Creek	140
Toohey's pond	35
Virden Pond	35
Wills's pond	35
Winn's lake	35
Woodward's lake	35
Maryland:	
Great Falls, Potomac River	1,015
Mount Rainier, Spring Pond	200
Massachusetts:	
Hampden, Big Casino Pond	200
Michigan:	
Bellaire, Grass Lake	140
Farwell, Bear Lake	70
Devils Lake	70
Putnam Lake	70
Thurston Lake	70
Minnesota:	
Lanesboro, Root River, North Branch	150
Root River, South Branch	150
Le Roy, Lake Wildwood	300
Minneapolis, Lake Calhoun	300
Lake Harriet	300
Preston, Root River, Middle Branch	250
Root River, South Branch	250
Rochester, Pettibone Park Lagoon	200
Zumbro River, South Branch	600
Mississippi:	
Meridian, Clark's pond	100
Wanita Club Pond	400
Woodside Pond	100
Missouri:	
Crescent, Lake Glen Metowee	100
Fordland, Collins's pond	100
Grandview, Blue Ridge Pond	100
Lake Clave	150
Horine, Windsor Lake	105
Independence, Treetop View Lake	100
Joplin, Thomas's lake	200
Kansas City, Clarke's pond	200
Dickey's pond	300
Lake of the Woods	200
Lumpkin Lake	400
Penn Valley Lake	200
Swope Park Lagoon	300
Kearney, Ludwig's lake	200
Lebanon, Cedar Lawn Pond	100
Oak Lawn Pond	100
Medford, Medford Reservoir	300
Milton's lake	200
Mexico, Burlington Lake	210
Mount Vernon, Baugh's lake	200
Spring River	400
Palmyra, Bay de Charles Lake	105
Platte City, Wilson lake	400
Rolla, Big Beaver Creek	300
Big Dry Fork Creek	300
Big Piney Creek	300
Cave Spring Creek	300
Gasconade River	300
Missouri—Continued.	
Rolla, Little Dry Fork Creek	300
Little Piney River	300
Mill Creek	300
North Spring Creek	300
St. Louis, Poupeny Lake	210
Montana:	
Kalispell, Hodgen's lake	95
New Jersey:	
Hackettstown, State fish commission	210
Sussex, Lake Pohuck	300
New York:	
Buffalo, State Institute Pond	300
Cuba, Cuba Lake	500
Middleton, Henneside Lake	300
Wallkill River	300
Rock Rift, Rock Lake	200
Roscoe, Amber Lake	500
Walden, Wallkill River	600
Willsborough, Hadley Pond	300
Rabbe Pond	200
North Carolina:	
Burlington, Glen Raven Pond	70
Jordan Pond	52
Toms Pond	53
Conway, Bridgers's pond	105
Flat Rock, Smyth's lake	52
Smythe's pond	35
Franklinton, Staley's pond	35
Gela, Lake Caldwell	140
Lilly Pond	53
Graham, Holt's pond	70
Kinston, Gill Pond	35
Jericho Pond	105
Morven, Covington's pond	35
Mount Airy, Buck Shoals Pond	105
Oxford, Clear Lake	140
Green's pond	70
Jackson's pond	105
Woodflief's pond	105
Pollocksville, Mill Creek	70
Raleigh, Country Club Lake	140
Milburnie Club Pond	105
Spring Hope, Soponia Pond	35
Warsaw, William's mill pond	70
Waynesville, Welch's pond	35
Wilson, Mill Pond	70
Wise, Hicks's pond	35
Ohio:	
Bellefontaine, Newell's lake	105
Bethel, Deep Lake	35
Cincinnati, Shaker Lake	60
Cleveland, Garfield Pond	35
Covington, Stillwater River, Kendalls Eddy	70
Dayton, Patterson's pond	35
Garrettsville, Silver Creek Pond	105
Kessler, Brush Creek	70
Lockland, Seillkopp Lake	30
Northside, Lake Kaelin	60
Portsmouth, Kern's pond	100
Sardinia, Mason's pond	60
Oklahoma:	
Ardmore, Ardmore Club Lake	105
Huffman's pond	35
Jolly's pond No. 1	35
Jolly's pond No. 2	35
Kinkade Lake	105
McCarty Lake	70
McCullom's pond	35
Remo Lake	35
Roberts's pond No. 2	35
Roberts's pond No. 3	35
Taylor's pond	35
Taylor's pond No. 2	35
Wallace's pond	35
Avard, Barnes's lake	200
Silver Lake	100

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

CRAPPIE AND STRAWBERRY BASS—Continued.

Disposition.	Fingerlings.
Oklahoma—Continued.	
Bridgeport, Robinson Creek	100
Canadian, Willow Lake	100
Carney, Anderson's lake	100
Chattanooga, Midland Farm Pond	200
Chelsea, Echo Lake	70
Cordell, Miller's pond	100
Crescent City, Wolf's pond	100
Cushing, Maramec Pond	55
Spencer's lake	55
Twin Elm Lake	55
Davenport, Hazelring's pond	35
Eldorado, Lawson Lake	100
Elk City, Lake Coleman	200
El Reno, Deep Lake	100
Enid, Elmwood Lake	100
Gage, Buzzard Pond	200
Guthrie, Silver Lake	300
Henryetta, City Reservoir	400
Hollister, Kinder's pond	200
Hooker, Friesen's pond	70
Knowles, Kite's pond	100
Lockridge, Hoover's pond	100
McAlester, Meadow Hill Lake	300
McFarland, Mill Creek	35
Mangum, Buena Vista Springs Branch	200
Chrystal Springs Creek	100
Marietta, Club Lake	105
Love Lake	35
Wood's lake	70
Meeker, Taft's pond	100
Mill Creek, Chilly Creek	200
Hepsy Creek	200
Mill Creek	200
Mountain View, Bear Creek	200
Buffalo Creek	300
Cobb Creek	200
Franklin Lake	200
Goom do Creek	200
Haley's lake	200
Little Cache Creek	200
Medicine Creek	200
Meek's lake	150
Oak Creek	200
Ringer's lake	200
Sohn's lake	200
Spencer Lake	100
Spring Creek	200
Swan Lake	300
Turkey Creek	200
Washita River	300
Muskogee, Silver Creek	70
Prague, Eret's lake	200
Pryor, Midway Lake	105
Roff, Zorn's pond	200
Sapulpa, Euchre Lake	105
Stillwater, Boomer Creek	200
Stillwater Reservoir	300
Tahlequah, Illinois River	300
Tulsa, Edgewood Lake	100
Locust Lake	100
Waynoka, Silver Springs Pond	100
Woodward, Snow Lake	200
Tousley's pond	100
Wynnewood, Harrison's pond	100
Panther Head Pond	100
Pennsylvania:	
Cambridge Springs, Edinboro Lake	300
Crafton, Perriwinkle Pond	200
Goldsboro, Susquehanna River	175
Johnstown, Ullery's pond	100
Lebanon, Lake Conewago	70
Light's lake	35
Mount Gretna Lake	35
Strack's lake	70
Water House Lake	70
Philadelphia, Park Aquarium	18
Wernersville, Tulpehocken Creek	70
South Carolina:	
Belton, Belton Mills Pond	53
Bethune, Cedar Pond	70
Horton's pond	35
Chappells, Strother's pond	35
Fairforest, Fairforest Creek	53
Gaffney, Byar's pond	35
Gray Court, Spring Run	35
Greenville, Hartzog Creek	35
Middle Saluda River	210
Reedy River	105
Saluda River	52
Littleton, Little River	122
Pendleton, Tine's pond	35
Pickens, Hendricks's pond	35
Ridge Springs, Kirk Creek	105
Wedgefield, Dwight's pond	35
Woodford, Justus's pond	70
South Dakota:	
Madison, Lake Hermosa	105
Lake Madison	105
Watertown, Lake Kampeska	175
Webster, Pickerel Lake	70
Tennessee:	
Ashland City, Newman's pond	30
Big Sandy, Dowdy's pond	100
Clarksville, Max's pond	52
Concord, Smith's pond	30
Cumberland Gap, Harrogate Pond	30
Gallatin, Fairview Pond	30
Johnson City, Watauga River	120
Kiser, Brown's pond	30
Knoxville, Big Flat Creek	90
Blake's pond	90
Holston River	90
Little Pigeon River, West Fork	90
Tennessee River	120
Manchester, Big Duck River	90
Duck River, Barren Fork	30
Morrison, Barren Fork Creek	60
Nashville, Caney Fork River	60
Smith Fork River	60
Newport, Eastport Pond	30
Shawanee, Cadle's pond	30
Trenton, Powell-Stephens's pond	150
Texas:	
Laredo, Ross's pond	30
New Braunfels, Landa's pond	20
San Antonio, Medina Valley Reservoir	100
Virginia:	
Allmonds Wharf, Stubbs's mill pond	200
Boyce, Spout Run	27
Buffalo Junction, Chandler's pond	27
Concord, Stratton Pond	30
Danville, Merriwold Lake	27
Cat Tail Pond	30
Ellerson, Fox's pond	200
Garrett's pond	200
Hewlett, Langdon Lake	30
Jarratt, Baptising Pond	30
Louisa, Harris Creek Pond	200
Williams's mill pond	200
Martinsville, Koehler's pond	27
Petersburg, Dunedin Pond	60
Harrison's pond	60
Jones's pond	60
Malone's pond	60
Titus's pond	60
Valley Farm Pond	60
Port Republic, South River	75
Providence Forge, Skidmore's pond	30
Rice Depot, Sailor Pond	30
Richmond, Falling Creek, headwaters	75
Scherer's pond	90
Scottsville, Albevanna Pond	30
Woodson's pond	30

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

CRAPPIE AND STRAWBERRY BASS—Continued

Disposition.	Finger-lings.
Virginia—Continued.	
South Clarksville, Pittard's pond	54
Stony Creek, Houle's pond	20
Strasburg, Shenandoah River	81
Sweet Hall, Custis Pond	225
Virgilina, Aaron's pond	27
Waverly, Niblette's pond	30
Wheeler, Lake Gibson	60
Woodstock, Powells Fort Creek	400
West Virginia:	
Clarksburg, Varner's pond	60
Wisconsin:	
Hatley, Crooked Lake	200
Lost Lake	200
Pike Lake	200
La Crosse, French Lake	100
Mississippi River	302,500
Nichols Bay	100
Rice Lake	100
Round Lake	100
Sand Creek	100
Zeislers Lake	100
Medford, Diamond Lake	250
Horse Shoe Lake	300
Klentsch's lake	250
Lake Easadora	250
Long Lake	550
Resech's lake	250
Rictor's lake	250
Sacket Lake	200
Twin Lake	200
Muscoda, Mill Creek Pond	105
Wisconsin—Continued.	
Norrie, Lake Mayflower	200
Richland Center, Pleasant Lake	300
State Line, Bass Lake	70
Goose Lake	140
Little Bass Lake	70
Merrell Lake	70
Tomahawk, Clear Lake	125
Lake Tomahawk	100
Mirror Lake	100
Reno Lake	100
Road Lake	125
Round Lake	100
Silver Lake	100
Skanawan Lake	100
Wisconsin River	150
Whitewater, Bass Lake	171
Cravath Lake	171
Lake Nine	171
Lauderdale Lake	171
Round Lake	206
Trippe Lake	171
Whitewater Lake	171
Whitewater Mill Pond	171
Wonewoc, Baraboo River, below dam	300
Baraboo River Mill Pond	300
Horse Shoe Pond	300
Rodgers Pond	300
Roeling Slough Pond	300
Woodland, Neosho Mill Pond	684
Total [a]	549,920

[a] Lost in transit, 2,698.

ROCK BASS.

Alabama:	
Abbeville, Yatta Abba Lake	200
Alexander, Smith's pond	200
Anniston, Garner's pond	100
Martin Cross Roads Pond	200
Stickney's pond	100
Banks, Tatom's pond	100
Bay Minette, Seabury Creek	250
Birmingham, Mountain Lake	300
Village Creek	200
Borden Springs, Mercer's pond	100
Stone Lake	300
Brownsboro, Flint River	400
Calcis, Jackson's pond	600
Camden, Bonner's lake	300
Ervin's pond	100
Ervin's upper pond	200
Carrollton, Lubbub Creek	300
Centerville, Lightsey's mill pond	300
Clayton, Norton's pond	100
Corduroy, West Lake	300
Cullman, Eight Mile Creek	300
Ryans Creek	200
Dadeville, Oil Mill Pond	100
Elba, Hudson Lake	100
Light Plant Pond	100
Taylor's mill pond	100
Thomas's mill pond	200
Wise's mill pond	200
Enterprise, Spring Pond	100
Eufaula, Maulthrop's lake	200
Fayette, Patterson's pond	100
Five Points, Wheeler's pond	300
Goodwater, Bailey's pond	300
Osbourn's pond	300
Gurley, Flint River	1,300
Huntsville, Flint River	1,300
Letohatchee, Mirror Lake	300
Alabama—Continued.	
Luverne, Kettler's pond	100
Sike's pond	100
Monroe, Bayles's pond	100
Montgomery, Cobbs Ford Lake	500
Perdido, Fletcher Creek	200
Prattville, Lucas Mill Creek	200
Repton, Baulware's pond	600
Escambia River, headwaters	400
Roanoke, Johnson's pond	100
Marsh's pond	300
Spring Pond	300
Russellville, Cobb Spring Pond	100
Lake Gayley	300
Seale, Benton's pond	500
Sprague, Ada Pond	100
Norman's pond	100
Talladega, Hick's pond	100
Troy, Lee Mill Pond	100
Tuskegee, Merritt's pond	300
Tyson, Monganville Pond	300
Union Springs, Worthington's pond	100
Valley Head, Moore's pond	100
Vinegar Bend, Escatawpa River	600
West Butler, Bogaloosa Creek	100
Arizona:	
Holbrook, Zuck's pond	100
Arkansas:	
Hope, Budwell's pond	100
Pleasure Lake	500
McNeil, Benvenue Club Pond	500
Magnolia, Askew Pond	300
Atkins's pond	300
Mammoth Spring, Tracey Creek	400
Ozan, Barrow's pond	200
Paragould, Finny Pond	100
Prairie Grove, Ozark Pond	200
Stephens, Haynie's pond	200

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

ROCK BASS—Continued.

Disposition.	Fingerlings.
Georgia:	
Braselton, East Lake	320
Harlem, Hubbard's pond	300
Rising Fawn, Riordan's pond	300
Roswell, Jones's pond	300
Tyrone, Ellison's pond	300
Illinois:	
Carbondale, Allen's lake	200
Indiana:	
Blocher, Fountain Farm Pond	250
Charlestown, Kraft's pond	250
Elkhart, Elkhart River	800
Gentryville, Maple Grove Pond	250
Marion, Mississinewa River	1,000
Mount Vernon, Shady Dell Pond	150
Vistula, Hunter Lake	1,200
Washington, Veal Creek Pond	250
White Pigeon, Stone Lake	700
Kansas:	
Jetmore, Pawnee Creek	100
Kentucky:	
Bowling Green, Brushy Fork Creek	300
Clear Fork Creek	250
Covington's pond	100
Gasper River	200
Schneider's pond	250
Cadiz, Caseys Creek	300
Danville, Dix River	500
Eminence, Banta's pond	250
Erlanger, Spring Pond	100
Greenville, McClellan's pond	400
Guthrie, Bland's pond	200
Bland's pond No. 2	150
Downer's pond	200
Heidelberg, Kentucky River	500
Hopkinsville, Little River, West Fork	300
Johnson Junction, Hart's pond	100
Lexington, Lake Ellerslie No. 3	500
Lake Ellerslie No. 5	500
Louisville, Wooldridge's pond	100
Nicholasville, Taylor's pond	250
Nolin, Crescent Pond	250
Paris, Maplehurst Pond	200
Princeton, McLinns Lake	200
Richmond, Garrison's pond	200
Stanford, Beck's pond	100
Louisiana:	
New Orleans, Soldiers Home Pond	100
Pelican, Chinquapin Lake	100
Sorrento, Opdenweyer-Fisher Pond	100
Maryland:	
Great Falls, Potomac River	2,800
Monrovia, White Oak Pond	100
Minnesota:	
Rochester, Zumbro River, South Branch	300
Mississippi:	
Aberdeen, Athens Creek	1,200
Bartlahatchie River	1,200
Jones Creek	1,200
Stonewall Creek	900
Como, Trotter's pond	150
Foster, Ratchford's pond	200
Knoxville, Cobb's pond	100
Louisville, Suttle's pond	100
McComb, Illinois Central Lake	200
McDonald, Watkins's pond	100
Osborn, Willow Pond	100
Pocahontas, Robinson's pond	100
Reform, Brooks's pond	100
Ripley, Yancey's pond	200
Shuqualak, Jones's pond	200
Willow Hill Pond	100
Tupelo, Park Lake	1,300
West, Johnson's pond	250
Missouri:	
Cascade, Clubb's pond	200
Lanagan, Edgewood Farm Pond	400
Missouri—Continued.	
Louisiana, Locust Grove Pond	200
Noel, Elk River	2,000
New Mexico:	
Wagon Mound, Culley's pond	100
New York:	
Walden, Wallkill River	450
North Carolina:	
Belmont, Catawba River, South Fork	150
Browns Summit, Pleasant Pond	150
Cary, Pleasant's pond	150
Cherryville, Lackey's pond	100
Jonesboro, Loyd's pond	300
Kinston, Loch Lily Pond	400
Little Switzerland, Davis's lake	300
Monroe, Quarry Lake	150
Newton, Bridges's pond	100
Bridges's pond No. 2	100
Southern Pines, Brookdale Pond	200
Summerfield, Robinson's pond	150
Taylorsville, Mesimore's pond	100
Ohio:	
Akron, Lake Ida	400
Bidwell, Jones's pond	300
Cleveland, Garfield Pond	100
Lake Erie	400
Columbus, Big Darby Creek	2,000
Little Walnut Creek	1,500
Garrettsville, Silver Creek Pond	100
Palmyra, Jones's pond	400
Washington Court House, Green's pond	400
Perrill's pond	200
Oklahoma:	
Comanche, Lockett's pond	150
Cushing, Lawson's pond	150
Enid, Harsh's pond	100
Frederick, Little's lake	400
Guymon, Barks's pond	150
Jet, Silver Lake	150
McComb, Klinglesmith's pond	100
Maud, Buckler's pond	200
Oklahoma City, Shepherd's lake	150
Pauls Valley, Spring Lake	200
Rocky, Lawhon's pond	100
Sallisaw, Ball Knob Pond	300
Shattuck, Kelen's pond	100
Snyder, Clear Lake	400
Stillwell, Horn Lake	300
Pennsylvania:	
Boston, Harper's pond	100
Curry, Meadow Branch	500
Du Bois, Hillcrest Pond	100
Lebanon, Lake Conewago	450
Mount Gretna Lake	450
Ligonier, Loyalhanna River	400
Rowland, Lackawaxen River	300
South Carolina:	
Anderson, Brogoa Mill Lake	200
Creamer's pond	100
McLeskey's pond	100
Snipes's pond	100
Bradley, Hickory Pond	200
Rock Spring Pond	100
Willow Pond	100
Cheraw, Knight's pond	150
Clover, Faris's pond	300
Greenville, Berkshire Hills Pond	300
Holly Hill, Rowser Lake	600
Laurens, Ramage's pond	100
Monetta, Mill Creek	200
Rock Hill, Aragon Cotton Mills Pond	250
Crockett Pond	250
St. Matthews, Wanamaker's pond	600
Sumter, Cain's pond	250
South Dakota:	
Bellefourche, Redwater River	250
Philip, Slovek's pond	250
Webster, Enemy Swim Lake	500

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

ROCK BASS—Continued.

Disposition.	Fingerlings.
Tennessee:	
Bethel Springs, Hester's pond	300
Cedar Hill, Red River, Sulphur Fork	500
Chattanooga, Montague Clay Pits	400
Norris Lake	900
Clarksville, Red River	200
Halls, Halls Pond	100
Hall's pond	100
La Follette, Dare Creek	100
Martha, Tubb's pond	200
Mason, Walsedge Pond	100
Milan, Fuqua's pond	100
Mount Pleasant, Big Bugbee Creek, West Fork	300
Sugar Creek, West Fork	300
Stanton, Wright's pond	100
Union City, Miles Pond	100
Tazewell, Parker's pond	150
Walling, Prater's pond	200
Wartrace, Wartrace Creek	300
Texas:	
Big Spring, McKinnon's pond	100
Brenham, Brenham Club Lake	200
Cooledge, Jackson's pond	50
Mayes's pond	50
Denison, Waterloo Lake	200
Eddy, Gin Pond	50
Fate, Kale's pond	50
Greenville, Burnett Pond	100
Dudding's pond	50
Loraine, Thompson's pond	50
Lyons, Uhlig's pond	50
Texas—Continued.	
Mexia, Kennedy's pond	50
Miles, Smith's pond	50
Pecos, Montgomery Pond	50
Orchard Pond	50
White House Pond	50
Rogers, Lake Minnie	50
San Antonio, Medina Valley Pond	500
San Marcos, Blue Pond	75
Santa Anna, Cherry's pond	75
Truscott, Coffman's pond	50
Weatherford, Grant's lake	50
Whitewright, Plot Grove Creek	100
Utah:	
Ogden, McComie's pond	200
Virginia:	
Beaver Dam, Bartlett's pond	325
Culpeper, Mountain Run	2,000
Drewrys Bluff, Kingsland Pond	150
Dunn Loring, Willowmere Lake	100
Gordonsville, Baker's pond	300
Howardsville, Dornoch Pond	750
Sunnyside Pond	1,250
Orange, Cloverdale Farm Pond	300
Marshall's pond	100
Mountain Run	100
Providence Forge, Skidmore's pond	300
Rock Castle, Dungeness Pond	200
Stuart, Round Meadow Creek	600
Thaxton, Ice Pond	150
Total[a]	78,045

[a] Lost in transit, 4,570 fingerlings.

WARMOUTH BASS.

Disposition.	Fingerlings, yearlings, and adults.
Maryland:	
Great Falls, Potomac River	1,085

SMALL-MOUTH BLACK BASS.

Disposition.	Fry.	Fingerlings, yearlings, and adults.
Arkansas:		
Mammoth Springs, Spring River		800
Connecticut:		
Bantam, Bantam Lake		300
Berlin, Hart Pond		450
Bridgeport, Hillside Pond		300
Darien, Gant's pond		150
East Haddam, Lake Bashau		791
East Hampton, Lake Pocotopaug		904
Granby, Cranberry Pond		300
Greenwich, Sabine Pond		100
Hartford, Lake Tarramuggus		300
Manchester, Globe Hollow Pond		300
Connecticut—Continued.		
Manchester, Marlborough Pond		300
Porter Pond		150
Newtown, Taunton Lake		450
Norwich, Beach Pond		73
Long Pond		73
Oxoboxo Lake		146
Ridgefield, Round Lake		300
Thompsonville, Trip Hammer Pond		219
Torrington, Highland Lake		450
Waterbury, Great Brook Pond		300
Hitchcock Pond		450
Lake Quassapaug		1,050

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

SMALL-MOUTH BLACK BASS—Continued.

Disposition.	Fry.	Fingerlings, yearlings, and adults.
Connecticut—Continued.		
Wilimantic, Lake Wamgumbaug		450
Colorado:		
Arboles, Piedra River		300
Illinois:		
Antioch, Huntley's lake		125
Red Bud, Roscow's lake		150
Wilmington, Forked Creek		250
Kankakee River		500
Indiana:		
Anderson, White River		250
Columbus, Driftwood River		220
Goshen, Elkhart River		250
Hamilton, Fish Lake		250
Terry Lake		125
Richmond, Whitewater River		200
Whitewater River, Nolans Fork		200
Trevlac, Bean Blossom Creek		400
Kentucky:		
Cadiz, Little River		600
Elizabethtown, Nolin River		300
Guthrie, Webb Pond		100
Maceo, Kingfisher Lake		100
Maine:		
Augusta, Lake Cobbosseecontee	4,000	
North Bridgeton, Long Lake	4,000	
Maryland:		
Great Falls, Potomac River		2,060
Massachusetts:		
Great Barrington, Harmon Pond		300
Lake Buel		300
Lake Garfield		300
Prospect Lake		300
Huntington, Westfield River, East Branch		565
Lee, Greenwater Pond	2,000	
Laurel Lake	2,000	
Lower Goose Lake	2,000	
Shaw Pond	2,000	
Stockbridge Pond	4,000	50
Upper Goose Pond	2,000	
Lynn, Upper Pond	1,000	
Newtonville, Bullough's pond		300
Webster, Lake Chaubunagungamaug		450
Winsted, Lake Marguerite		450
Michigan:		
Alpena, Long Lake		500
Athens, Notawasippi River		200
Beulah, Crystal Lake		1,500
Big Rapids, Chippewa Lake		750
Bridgeport, Sylvan Lake	3,000	
Brighton, Woodruff Lake		800
Buchanan, Clear Lake		250
Charlevoix, Pine Lake		250
Pine Lake, South Arm		250
Chelsea, Stapish Lake		250
Clarkston, Park Lake		600
Clyde, White Lake		500
East Saugatuck, Gosshorn Lake		250
Ellsworth, Harwood Lake		250
St. Clair Lake		3,000
Michigan—Continued.		
Farwell, Dead Man Lake		500
Glass Lake		500
Jimmy Wau Lake		500
Grayling, Portage Lake		500
Greenville, Blue Lake		500
Clifford Lake		800
Como Lake		500
Fish Lake		800
Sanderson Lake		800
Thomas Lake		800
Turk Lake		800
Woodbeck Lake		600
Hastings, Carter Lake		125
Gregory Lake		125
Head Lake		125
Leech Lake		125
Long Lake		125
Middle Lake		125
Mixer Lake		125
Pine Lake		125
Podunk Lake		125
Pond Lily Lake		125
Tanner Lake		125
Tilson Lake		125
Highland, Lake Dunham		1,500
Hillman, Brush Lake		250
Dishaw Lake		250
Jackson Lake		250
Leeches Lake		250
Rush Lake		250
Valentine Lake		250
Holland, Black Lake		250
Holly, Bevens Lake		500
Mallett Lake		500
Indian River, Upper Twin Lake		500
Jackson, Portage Lake		250
Vandercook Lake		250
Lake George, Lake George		500
Shingle Lake		500
Lapeer, Nippissing Lake		800
Skinner Lake		600
Lawrence, Reynolds Lake		250
Leonard, Echo Lake		1,200
Lovells, Shoe Pac Lake		500
Marcellus, Howardsville Mill Pond		250
Louis Lake		250
Rocky River		250
Marshall, Lyon Lake		250
Niles, Dowagiac Creek		500
St. Joseph River		500
Northville, Corley Lake		500
Oxford, Big Fish Lake		800
Davison Lake		400
Ramona, Diamond Lake		250
Rose Center, Arnold's pond		300
Buck Horn Pond		600
Bush Lake		600
Chase Lake		600
Crafts Lake		600
Downing Lake		600
Elliott Lake		600
Esler Lake		600
Good Fellow Lake		600
Green Lake		300
Hankinson Lake		600
Harris Lake		600
Highfield Lake		600
Home Lake		600

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

SMALL-MOUTH BLACK BASS—Continued.

Disposition.	Fry.	Fingerlings, yearlings, and adults.
Michigan—Continued.		
Rose Center, Kelly Lake		600
Melvin Lake		600
Mud Lake		600
Randell Lake		600
Round Lake		600
Taylor Lake		600
Winter Lake		600
Shelby, Stony Lake		250
White Cloud, Big Robinson Lake		800
Missouri:		
Neosho, Shoal Creek		300
Ritchey, Shoal Creek		300
Rolla, Smith Spring Creek		200
Montana:		
Kalispell, Church Lake		50
Emmert Lake		100
Somers, Horse Shoe Lake		50
New Hampshire:		
Antrim, Gregg Lake	3,000	
Concord, Contoocook River	4,000	
Meredith, Lake Winnepesaukee	5,000	75
New Jersey:		
Andover, Goodale's pond		450
Blairstown, Sucker Pond		600
Boonton, Green Pond		900
Hacketstown, Allemuchy Pond		400
Musconetcong River Basin		200
Mays Landing, Lake Lenape		400
Netcong, Budd Lake		750
Princeton Junction, Carnegie Lake		400
New Mexico:		
Raton, Throttle Pond		200
New York:		
Addison, Canisteo River		250
Tuscarora Creek		250
Arden, Cranberry Lake		600
Brewster, Peach Lake		300
Cambridge, Hedges Lake		200
Lake Lauderdale		200
Craryville, Copake Lake		246
Central Valley, Lake Georgene		100
Delmar, White Cap Pond		200
High View, Shawangunk Kill River		400
Lake Clear Junction, Osgood Lake		300
Middletown, Wallkill River		400
New Rochelle, Water Company Reservoir		600
Rochester, Poplar Pond		125
Salem, Lake Cossayuna		200
Syracuse, Cazenovia Lake		125
Cross Lake		125
Otisco Lake		125
Skaneateles Lake		125
Tully Lake		125
Troy, Babcock Pond		200
Ulster Park, Lake Esopus		300
Walden, Wallkill River		300
Wayland, Loon Lake		125
West Point, Round Pond		400
North Carolina:		
Asheville, Lake Fernhurst		200
Carey, Waldo's pond		100
Catawba, Piney Woods Branch		100
North Carolina—Continued.		
Flat Rock, King's pond		200
Hickory, Catawba River		200
Hope Mills, Little Rockfish Creek		200
Horse Shoe, Mills River		200
Lakeville Junction, Pumpkin Creek		100
Murphy, Hiawassee River		250
Ohio:		
Columbus, Alum Creek		250
Big Walnut Creek		250
Olentangy River		250
Scioto River		250
Garrettsville, Camp Creek Pond		125
Newark, Brushy Fork Creek		375
Raccoon Creek		375
Urbana, Twin Lakes		300
Wilmington, Porter's pond		125
Xenia, Little Miami River		250
Pennsylvania:		
Atglen, Octorara Creek		300
Bedford, Raystown Branch		300
Centralia, Roaring Creek		250
Columbia, Chichies Creek		300
Denver, Buchers Dam		200
Leeds Run		100
Stony Run		100
Franklin, French Creek		250
Greenville, Big Shenango River		250
Little Shenango River		250
Hanover, Conewago Creek		200
Hosensack, Hancock Pond		1,050
Huntingdon, Raystown Branch		400
Indian Creek, Indian Creek		300
Lebanon, Bohrs Ford Pond		100
Bohrs Ford Run		100
Gerhardt's pond		100
Gray's pond		100
Kline's pond		100
Light's pond		200
Mish's mill pond		100
Strack's lake		200
Swatara Creek		100
Union Waterworks Lake		100
Wellman's pond		100
Lititz, Cocalico Creek		200
Meadville, Conneaut Lake		125
Meehoopany, Susquehanna River		250
Montoursville, Loyalsock Creek		300
New Brittain, Neshaminy Creek		300
Oaks, Perkiomen Creek		300
Oil City, Allegheny River		250
Philadelphia, Upper Darby Creek		250
Reading, Tulpehocken Creek		200
Spring City, French Creek		300
Pickering Creek		300
Swamp Creek		300
Standing Stone, Susquehanna River		250
Stroudsburg, Delaware River		400

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

SMALL-MOUTH BLACK BASS—Continued.

Disposition.	Fry.	Fingerlings, yearlings, and adults.
Pennsylvania—Continued.		
Thompson Station, Allegheny River, Thompson Eddy		250
Uniontown, Gorley's lake		200
Sandy Creek		200
West Chester, Brandywine Lake		100
Lenape Lake		300
Wilkes-Barre, Spring Lake		125
Rhode Island:		
Clear River, Wallum Lake		150
Providence, James Pond		150
Wakefield, Silver Lake		173
South Carolina:		
Cheraw, Beaver Creek		200
Buck Hole Creek		100
South Dakota:		
Bellefourche, Bellefourche Lake		300
Tennessee:		
Clarksville, Red River		200
Vermont:		
Barton, Parker Pond	3,000	
Canaan, Wallis Pond		200
Hardwick, Little Hosmer Pond	4,000	
Valley Lake	4,000	
Lakeside, Groton Lake	4,000	
Lyndonville, Center Pond	4,000	
Vermont—Continued.		
Miles Pond, Miles Pond	4,000	
Montpelier, Curtiss Pond	3,000	
Rickers Mill, Rickers Pond	3,000	
Rocky Point, Groton Pond	4,000	
Swanton, Lake Champlain		1,200
Vergennes, Little Otter Creek		200
Otter Creek		200
Virginia:		
Ashby, Shenandoah River	5,000	
Bentonville, Shenandoah River	5,000	
Millboro, Cow Pasture River	5,000	
Washington:		
Kahlotus, Washtucua Lake		120
Spokane, Liberty Lake		480
West Virginia:		
Sheldon, Elk River	5,000	
Wisconsin:		
Grand Rapids, Wisconsin River		2,000
Star Lake, Lake Laura		500
Star Lake		500
Wyoming:		
Cheyenne, Fort Laramie Pond		150
Total[a]	91,000	96,745

[a] Lost in transit, 1,856 fingerlings.

LARGE-MOUTH BLACK BASS.

Disposition.	Fingerlings, yearlings, and adults.
Alabama:	
Abbeville, Choctawhatchie River	80
Varm's pond	20
Albertville, Barrontine's pond	100
Alpine, Wewoka Creek	60
Andalusia, Knox's pond	30
Oliver's pond	50
Anniston, Lake Keefer	100
Ashby, Six Mile Creek	10
Bay Minette, Irwin's pond	100
Bellwood, Vaughn's pond	30
Billingsley, Foshee's pond	25
Birmingham, Number 7 Lake	150
Number 12 Lake	100
Village Creek Pond	150
Blocton, Blake's lake	10
Hills Creek	10
Reynolds's pond	10
Schultz Creek	10
Blocton Junction, Bibbville Pond	10
Giles Pond	10
Booth, Hauser's pond	25
Whitewater Pond	50
Borden Springs, Terrapin Creek	300
Brewton, Burnt Corn Creek	300
Weaver's pond	150
Brierfield, Little Cahaba River	10
Mahan Creek	10
Mabery Creek	10
Shoals Creek	50
Alabama—Continued.	
Burksville, McCarty Pond	150
Calcis, Kelly Creek	200
Capps, Alexander's pond	40
Choctawhatchie River, East Branch	20
Roberts's mill pond	20
Castleberry, Etheridge's pond	150
Centerville, Spring Hill Pond	25
Citronelle, Manns Lake	300
Clanton, Foshee's pond	10
Mim's pond	10
Clayton, Brown's pond	10
Kennedy's pond	10
McNab's pond	10
Robertson's lake	10
Clio, Brock's mill pond	10
Corduroy, West Lake	300
Drewry, Halter's mill pond	150
Duke, Lee's pond	100
Elamville, Burke's pond	10
Elba, Ham's mill pond	10
Hurricane Lake	30
Lake Henderson	50
Phillips's pond	50
Sawyer's mill pond	20
Tates Old Mill Pond	20
Eoline, Johnson Mill Pond	50
Murphy's pond	25
Eufaula, Guice's lake	10

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

LARGE-MOUTH BLACK BASS—Continued.

Disposition.	Fingerlings, yearlings, and adults.
Alabama—Continued.	
Eufaula, Whitlock's pond	10
Evergreen, Deming's pond	200
Herrington's pond	300
Shipp's pond	300
Fitzpatrick, Pickett's pond	10
Five Points, Avery's pond	10
Florala, Lake Jackson	610
Florence, Big Cypress Creek	300
Mussel Shoals Canal	200
Gadsden, Big Cove Creek	100
Black Creek Pond	100
Glenwood, McDougall's pond No. 1	40
McDougall's pond No. 2	30
Goodwater, Hatchett Creek	30
Jayner Lake	10
Kennedy Eddy	10
Ross Eddy	10
Wildcat Creek	10
Greenville, Barganier Mill Pond	150
Moscley's mill pond	150
Pine Barren Creek	200
Sirmon's mill pond	100
Gulfcrest, Holly Glen Pond	150
Hardaway, Gregory Lake	10
Headland, Money's pond	20
Phillips's pond	40
Hodges, Dollar Creek	250
Inverness, Jenkin's pond	20
Jacksonville, Treadway's lake	100
Johns, Big Blue Creek	300
La Pine, Davis's pond	40
Lanford's pond	40
Letohatchee, Cold Spring Pond	75
Elm Pond	75
Garnett Mill Pond	75
Willow Pond	75
Lineville, Smith's lake	50
Longview, Lake Adams	10
Stewart Lake	10
Lowndesboro, Wooten Pond	100
Marbury, Thompson Lake	10
Marvel, Savage Creek	10
Midland City, Blakum's pond	40
Millry, McLemore's mill pond	200
Martin's mill pond	200
Mobile, Halls Mill Creek	300
Lake Hurieosco	200
McGowin's pond	100
Montgomery, Cobbs Ford Lake	30
Mill Creek	50
Moundville, King's pond	100
Naftel, Mineral Pond	50
Oakwood Pond	50
Oneonta, Allgood's mill pond	100
Little Warrior River	100
Mill Creek	200
Perdido, Thornley's pond	100
Pine Apple, Mineral Spring Lake	150
Prattville, Bell's pond	75
Mill Pond	75
Smith's pond	75
Tucker's pond	75
Ragland, Trout Creek	200
River Falls, Gantt's pond	60
Rock Run Station, Hurricane Creek	300
Russellville, Burgess's lake	125
Samson, Bruson's pond	50
Sanie, Margaret Lake	400
Selma, Ivey Pond	100
Speigner, Shelton Spring Pond	20
Sprague, Horn Pond	50
Stanton, Big Mulberry Creek	300
Sylacauga, Prather's pond	10
Thomaston, Thomaston Lake	100
Alabama—Continued.	
Tredegar, Tredegar Lake	200
Troy, Dickinson's pond	50
Henderson's pond	50
Henderson's pond No. 2	50
Youngblood Mill Pond	50
Tyler, Edward's pond	100
Edward's pond No. 2	100
Lambright Creek	100
Tyson, Oilmill Pond	75
Union Springs, Lee's pond	30
Place's pond	10
Vinegar Bend, Escatawpa River	400
Welch, Chicksanoxsee Pond	10
Wetumpka, College Hill Pond	10
Hillside Pond	10
Robbins's lake	10
Wilsonville, Beeswax Creek	10
Arizona:	
Flagstaff, Mormon Lake	36
Holbrook, Becker's lake	24
Lyman Reservoir	36
Woodruff Lake	36
Wickenburg, Hassayampa River Pond	12
Arkansas:	
Brentwood, White River, West Fork	300
Clow Station, Sampson's pond	100
Graysonia, Antoine River	500
Harrison, Crooked Creek	300
Heber Springs, Little Red River	300
Helena, Blue Hole Lake	200
Leslie, Little Red River, North Fork	400
Magnolia, Askew Pond	100
Whiddon's pond	100
Mammoth Springs, Myatt River	300
Spring River	400
Ola, Keelon Lake	300
Prairie Grove, Illinois River	300
Readland, Grand Lake	400
Shirley, Little Red River, Archie Fork	600
Stephens, Haynie's pond	100
Wickes, Ozark Spring Lake	230
Wilmot, Lake Enterprise	250
Colorado:	
Brighton, Thompson's lake	20
Durango, Animas River	24
Chapman's lake	24
Williams's pond	24
East Lake, Schradsky's lake	10
Fort Logan, Rucker's lake	20
La Veta, Wahatoya Lake	100
Loveland, Alford's lake	20
Bonnell's lake	10
Guard Lake	20
Home Supply Reservoir	20
Ryan Gulch Lake	20
Milliken, Morgan's lake	20
Miramonte, Carter's lake	100
Walsenburg, Coler Lake	24
Elks Club Lake	24
Lake Meriam	24
Connecticut:	
Bantam, Bantam Lake	200
Tariffville, Farmington River	300
Mystic, Long Pond	300
South Kent, Hatch Pond	600
Leonard Pond	300
Delaware:	
Houston, Wilsons Mill Pond	36
District of Columbia:	
Washington, Rock Creek	150
Florida:	
Altamonte Springs, Lake Adelaide	900
Fort Myers, Caloosahatchie River	5,500
Jupiter, Loxahatchee Creek	900

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

LARGE-MOUTH BLACK BASS—Continued.

Disposition.	Fingerlings, yearlings, and adults.
Georgia:	
Atlanta, Capitol Aquariam	25
Augusta, Butlers Creek	15,000
Bartow, Triplet Pond	100
Hawkinsville, Duke's pond	150
Lagrange, Callaway's ponds	175
Newnan, Pearl Spring Lake	7,000
Norwood, Bradshaw's pond	3,000
Ray's pond	6,000
Rock Creek	6,000
Swain's pond	3,000
Roberta, Highland Pond	200
Stilson, Ogeechee River	400
Sylvania, Walker's mill pond	300
Thomasville, Oclochnee River	8,600
Pebble Lake	150
Waynesboro, Brier Creek	300
McBean Creek	300
Wellston, Lewis's pond	400
Zebulon, Parker's mill pond	125
Idaho:	
Addie, Monaloha Lake	200
Queen Lake	200
Robinson's lake	100
Genesee, Brigham's lake	100
Priest River, Hager's lake	20
Illinois:	
Albion, Brick Co. Pond	200
Alvin, Vermilion River, North Fork	800
Assumption, Lake Falk	24
Aurora, Fox River	400
Barrington, Bangs Lake	400
Belvidere, Kishwaukee River	400
Benton, Seeber's pond	200
Ward's lake	200
Williams's pond	150
Brighton, Stubblefield's lake	60
Carbondale, Easterly Lake	150
Taylor Lake	150
Thompson Lake	300
Carlinville, Beaver Dam Lake	60
Carrollton, Elm Grove Pond	45
Casey, Weaver's pond	600
Chicago, Dead Lake	400
Clay City, Valley Spring Lake	800
Coulterville, Coal Mine Lake	100
Illinois Central Lake	300
Crystal Lake, Crystal Lake	400
Danville, Vermilion River, Middle Fork	224
Decatur, Homewood Fishing Club Lake	400
Dixon Springs, Rainbow Lake	150
Effingham, Illinois Central Reservoir	800
Franklin, Burlington Lake	150
Galesburg, Lake Rice	600
Soangetaha Club Pond	600
Grayslake, Grays Lake	400
Taylor Lake	400
Hillsboro, Club Lake	175
North Lake	175
South Pond	175
Kankakee, Kankakee River	1,000
Lemont, George Lake	400
Marion, C. & E. I. Lake	200
Goodall's lake	200
Hudgens Club Lake	200
Marshall, Crystal Lake	400
Spring Lake	200
Meredosia, Meredosia Bay	50
Mississippi River	190
Montrose, Ferndale Pond	200
Mount Vernon, Prairie Pond	100
Paris, Spring Lake	600
Red Bud, Owens Pond	200
Rockefeller, Lake Era	400
Illinois—Continued.	
Round Lake, Round Lake	400
Sconce, C. & E. I. Reservoir	200
Sparta, Moffat's pond	100
Staunton, City Reservoir	48
Stonington, Heflin's pond	24
Teutopolis, Funnemann's pond	200
Tiskilwa, Hennepin Canal	400
West Chicago, Bolles's lake	400
Wyanett, Illinois & Mississippi Canal	400
Indiana:	
Angola, Golden Lake	300
Hogback Lake	300
Bethany Park, Bethany Lake	1,600
Bloomfield, Richland Creek	600
Bloomington, Bloomington Pond	400
University Pond	400
Chalmers, Judd's pond	100
Columbus, Flat Rock Creek	3,200
Corydon, Crystal Lake	150
Delong, Tippecanoe River	300
Dunkirk, Mississinewa River	200
Eaton, Mississinewa River	300
Elkhart, Boston Lake	48
St. Joseph River	200
Simonton Lake	24
Fort Wayne, Cedar Creek	24
Kawe Lake	24
Maumee River	24
St. Joseph River	48
St. Marys River	24
Sylvan Lake	24
Frankton, East's pond	100
Henryville, Taylor's lake	600
Hobart, Lake George	200
Howe, North Twin Lake	300
Indianapolis, Fall Creek	300
White River	300
Kewanna, Bruce Lake	300
Kyana, Chanley's lake	150
Marion, Mississinewa River	48
Michigan City, Hanson's pond	20
Milton, Beesons Station Pond	200
Martinsdale Creek	500
Symons Creek	400
Whitewater River, Green Fort	400
Whitewater River, Nolans Fork	500
Whitewater River, West Fork	500
Muncie, White River	400
New Carlisle, Hudson Lake	20
North Liberty, Sousleys Lake	300
North Vernon, Muscatatook River	600
Plymouth, Hast Lake	150
Lawrence Lake	20
Ray, Clear Lake	300
Long Lake	300
Round Lake	212
Richmond, Richmond Lake	400
Ridgeville, Judy's pond	100
Rolling Prairie, Silver Lake	20
Rome City, Sylvan Lake	300
Scottsburgh, Iola Lake	1,200
Stearley, Stenerwald's pond	200
Topeka, First Lake	200
Hackenburg Lake	200
Meesic Lake	24
Second Lake	200
Third Lake	200
Valparaiso, Flint, Long, and Wahub Lakes	50
Veedersburg, Coal Creek	300
Iowa:	
Alton, Floyd River, West Branch	400
Bellevue, Mississippi River	43,000
Boyd, Wapsipinicon River	300

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

LARGE-MOUTH BLACK BASS—Continued.

Disposition.	Fingerlings, yearlings, and adults.
Iowa—Continued.	
Burlington, C., B. & Q. Reservoir	300
Colfax, Spring City Lake	250
Council Bluffs, Lake Mannawa	200
Decorah, Iowa River, Upper	500
Emmettsburg, Medium Lake	500
Hedrick, Skunk River	500
Keokuk, Cooper Lakes	500
Lidderdale, Schleisman's pond	150
Manchester, Maquoketa River	1,200
Milton, Johnson's pond	200
Moulton, Wabash Pond	200
Ottumwa, Lake Burns	300
Richland, Skunk River	500
Ruthven, Lost Island Lake	300
Stacyville, Little Cedar River	300
Waverly, Red Cedar River	500
West Liberty, Pike Run	150
Kansas:	
Abilene, Acme Lake	24
Bonner Springs, Neconhecon	100
Edwardsville, Lake of the Forest	700
Holton, Love-Joy Pond	36
Langdon, Hatchery Ponds	200
Lenexa, Overland Lakes	36
Scottsville, Bower's pond	24
Welda, Welda Reservoir	400
Kentucky:	
Bonnieville, Bacon Creek	150
Bowling Green, Barren River, Lower	675
Garvin's pond	225
Goodrum's pond	225
Green River	450
Harris's pond	225
Hogan's pond	900
Hunter's pond	225
Jenkins's pond	225
Lawrence's pond	225
McGinnis's pond	225
Mitchell's lake	225
Mitchell's lake No. 2	450
Petty's pond	225
Searcy's pond	225
Shelton's pond	675
Trammel Creek	450
Brandenburg, Bewley's pond	75
Bristow, Doty's pond	75
Meredith's pond	75
Dexter, Clarks River	300
Eastview, Grass Lot Pond	155
Elkton, Trabue Pond	225
Erlanger, Utz's pond	24
Ferguson, Whippoorwill Creek	700
Garfield, Bruner's pond	50
Marr's pond	50
Glencoe, Garvey's lake	12
Hopkinsville, Childress's pond	225
Little River, West Fork	500
Witty's pond	225
Lexington, Green Hills Lake	12
Mayfield, Stanfield's pond	100
Munfordville, Lakeview Pond	125
Rockfield, Shanks's lake	675
Rocky Hill Station, Grove Pond	125
Rowletts, Lester's pond	200
Russellville, Mud River	450
Town Creek	450
St. Johns, Ball Hill Pond	150
Smiths Grove, Cole's pond	75
Stephensburg, Stephensburg Lake	225
Vanceburg, Kinniconick Creek	60
Vine Grove, Brushy Fork Creek	130
Ice House Pond	65
Norris's lake	140
Willow Pond	65
Kentucky—Continued.	
Webster, Blue Pond	90
Winchester, Jockey Club Lake	60
Louisiana:	
Bullion, Magnolia Lodge Lake	100
Genesee, Genesee Pond	100
Plaquemine, Bayou Labutte	60
Rio, Sanford's pond	35
Maine:	
Livermore Falls, Davids Pond	80
Maryland:	
Bowie, Crystal Lake	12
Gaithersburg, Hawlings River	36
Great Falls, Potomac River	2,250
Lime Kiln, Grove Quarry Pond	24
Massachusetts:	
Adams, Mountain View Pond	100
Ashburnham, Naukeag Lake	200
Ward Pond	200
Bridgewater, Red Brook Pond	100
Clinton, Mossy Pond	200
Falmouth, Grews Pond	150
Gloucester, Cape Pond	300
Hyannis, Wequaquet Lake	300
Lee, Upper Goose Pond	400
Millbury, Dority Pond	200
Plymouth, Indian Brook	100
Pittsfield, Richmond Pond	300
Shelburne Falls, Ashfield Pond	100
South Hanson, Big Sandy Pond	200
Furnace Pond	200
South Vernon, St. Patricks Pond	150
Springfield, Hatchery Pond	400
Ware, Hardwick Lake	300
Woods Hole, Cedar Tree Neck Pond	150
Joves Neck Pond	200
Minnesota:	
Crosby, Serpent Lake	48
Deerwood, Serpent Lake	40
Homer, Broken Arrow Slough	300
Closing Dam No. 3	250
Dam No. 1	400
Pettibone Park Lake	300
Lanesboro, Mill Pond	255
Root River, North Branch	255
Root River, South Branch	295
Le Roy, Little Iowa River	300
Upper Iowa River	300
Little Falls, Duck Lake	30
Fish Lake	30
Madison Lake, Duck Lake	48
Lake Ballentyne	41
Madison Lake	48
Mankato, Washington Lake	200
Minneapolis, Cedar Lake	300
Lake Harriet	300
Preston, Root River	295
Princeton, Spectacle Lake	300
Racine, Bear Creek	300
Rochester, Lake Shady	400
Zumbro Mill Pond	700
Zumbro River	1,100
Spring Valley, Bear Creek	200
Deer Creek	250
Mississippi:	
Brookhaven, Spirit Lake	325
Calhoun City, Moore's pond	100
Columbus, Tombigbee River	200
Falkner, Tapp's pond	200
Knoxville, Green's pond	200
Schropshire's pond	200
Tillery's pond	100
Laurel, Phalti Lake	45
Lumberton, Lee Pond	200
Natchez, Sunnyside Pond	150

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

LARGE-MOUTH BLACK BASS—Continued.

Disposition.	Fingerlings, yearlings, and adults.
Mississippi—Continued.	
Oakley, Oakley Lake	150
Perkinston, Beaverdam Pond	200
Ripley, Smith's pond	100
Shuqualak, Clear Water Pond	100
Dugan's pond	200
Stewart, Mullins's pond	125
Missouri:	
Bunker, Black River, West Fork	400
Helena, Nuckols Lake	200
Holmes Park, Lakewood Farm Lake	300
Kansas City, Cave Spring Lake	100
Lake of the Woods	300
Penn Valley Lake	100
Swope Park Lagoon	200
Kearney, Ludwig's lake	200
Lebanon, Gasconade River, Osage Fork	100
Lockwood, Lockwood Lake	173
Mount Vernon, Williams Creek	77
Neosho, Spring Lake	100
Parkville, Emily Heights Pond	150
Ste. Genevieve, Basler Lake	150
Sexaner Pond	200
St. Joseph, Crowley's lake	100
St. Louis, Lake Christine	60
Savannah, Blakeslee's lake	150
Seneca, Little Lost Creek	100
West Plains, Woodside Pond	200
Willow Springs, Sass's lake	200
Montana:	
Baker, Baker Lake	23
Bozeman, State fish commission	66
Devon, Fowler's lake	14
Eureka, Dupuis's lake	27
Helena, Hauser Lake	30
Townsend, Missouri River, branch of	30
New Hampshire:	
Berlin, Head Pond	90
Somersworth, Libby Pond	120
New Jersey:	
Andover Junction, White's pond	24
Bakersville, Somers Brick Co. Ponds	300
Camden, Porchtown River	300
Morris Plains, Aloha Lake	36
Woodbury, Harrisonville Pond	300
New Mexico:	
Aztec, Goulding's pond	75
Cedar Hill, Las Animas River	24
Colmor, Springer Lake Co. Lake	24
Las Vegas, Buena Vista Lake	24
Chupainas Lake	12
Magdalena, Thomas Lake	24
Maxwell, Lake Twenty	48
Onava, La Jara Lake	12
Raton, Bell's lake	12
Springer, Mesa Lake	48
Wagon Mound, Gallegas Lake	36
Lopez's pond	12
New York:	
Altmar, Stevens Cold Brook Pond	48
Au Sable Forks, Fern Lake	500
Bay Shore, Big Oaks Pond	125
Carthage, Black River	48
Clayton, St. Lawrence River	180
Eagle Bridge, Dead Pond	390
Hedges Lake	300
Lake Lauderdale	300
Fishkill, Brinckerhoff Pond	100
Briney River Pond	300
Middletown, Henneside Lake	400
Wallkill River	475
Monticello, Lake Superior	125
New Lebanon, Adams Pond	125
Shaker Pond No. 1	200
Shaker Pond No. 2	200
Ronkonkoma, Lake Ronkonkoma	48
New York—Continued.	
Roscoe, Amber Lake	48
Sayville, Lotus Lake	48
Suffern, Putney Lake	125
Willsborough, Echo Lake	250
North Carolina:	
Apex, Gunter's pond	509
Wimbley's pond	500
Asheville, Lake Juniata	240
Bailey, Sunny Brook Pond	200
Barnard, French Broad River	100
Belew Creek, Belew Creek	60
Belmont, Catawba River	120
Catawba River, South Fork	120
Bryson City, Tuckaseigee River	130
Cary, Waldo's pond	10
Catawba, Balls Creek Pond	160
Bull Run Pond	80
McKinzie Branch	80
Piney Woods Branch	50
Council, Ashwood Pond	100
Dillsboro, Tuckaseigee River	300
Duke, Bee B-Pond	60
Efland, Eno River, tributary	50
Elizabethtown, Jones Lake	150
White Lake	200
Elkton, Smith's pond	110
Flat Rock, Lowndes's pond	20
Ottaway Lake	20
Greensboro, Buffalo Lake	120
Cables Lake	60
Johnson's lake	120
Pole Cat Creek	400
Hendersonville, Hillside Park Lake	60
Lake Wajaw	40
Nymphaea Pond	20
Hickory, Catawba River	30
Hillsboro, Carr's pond	60
Eno River	30
Occoneechee Pond	625
Jacksonville, New River and tributaries	88
Kinston, Dupree's pond	400
Gray's pond	100
Lake Toxaway, Lake Toxaway	400
Manson, Nutbush Pond	60
Marion, Bailey's pond	80
Brown's pond	80
Coon Hollow Creek	80
Davis Creek	80
Good's pond	80
Hunters Mill Pond	80
Kanipes Pond	80
Morgan & Bennett Lake	80
Pole Cat Creek	80
Pool's pond	80
Ray's pond	80
Sampson's pond	80
Shelter Creek	80
Sinclair Burnt Mill Pond	80
South Fork Creek	80
Tate's pond	80
Toms Creek	80
Woodlawn Lake	80
Marshall, French Broad River Pond	100
Teague's pond	50
Mayesworth, Duharts Creek	72
Mebane, Murray Hill Camp Pond	240
Morgantown, Catawba River, Left Fork	160
Morrisville, Sycamore Creek	30
Mortimer, Wilson Creek	160
Morven, Ham's pond	50
Murphy, Beach Creek Pond	60
Mission Pond	340
Newton, Falling Creek Pond	80

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

LARGE-MOUTH BLACK BASS—Continued.

Disposition.	Fingerlings, yearlings, and adults.
North Carolina—Continued.	
Old Fort, Curtis Creek	60
Parkton, Hughes's mill pond	120
Princeton, Little River	400
Raleigh, Country Club Pond	400
Lake Raleigh	600
State Prison Lake	75
Rutherfordton, Green River Lake	90
Skyland, Doe Pond	80
Sulphur Springs, Asheville School Lake	120
University, Mill No. 7 Pond	10
Wake Forest, Griffin's pond	60
Oneal's pond	60
Waynesville, East Fork Lake	130
Wendell, Richardson's pond	400
Wilmington, Greenfield Lake	300
Wilson, Grantham's pond	200
Ohio:	
Tiffin, Lake Mohawk	60
Oklahoma:	
Gage, Cliff Lake	200
Deep Lake	100
Sand Lake	200
Goodwin, Griffis's pond	100
Richards's lake	100
Guthrie, Silver Lake	36
Holdenville, Clawson's pond	200
McCourry's pond	100
McAlester, Anderson's lake	100
Nelson's pond	200
Power House Lake	200
McComb, Motley's pond	200
McFarland, Mill Creek	24
Mill Creek, Bushby Creek	24
Flood Creek	24
Squaw Creek	24
Three Mile Creek	24
Nowata, Wilkinson's lake	24
Oklahoma City, Shepherd's lake	36
Optima, Ansley's pond	12
Shawnee, Broadway Lake	150
Woodward, Clines Spring Lake	100
Kempf's lake	100
Williams's pond	100
Oregon:	
Eagle Point, Kinney's lake	50
Pennsylvania:	
Ashland, Mahantongo Creek	250
Beatty, St. Vincent Pond	400
Bedford, Dunnings Creek	200
Rayston Branch	200
Beech Creek, Bald Eagle Creek	4
Beech Creek	4
Marsh Creek	4
Birdel, Brandamore Creek	48
Blairsville, Conemaugh River	66
Bloomsburg, Fishing Creek	250
Bushkill, Deer Lake	24
Forest Lake	72
Lake Taminent	24
Catawissa, Roaring Creek	125
Clifton, Bear Lake	400
Costello's pond	250
Cochranton, French Creek	100
Dubois, Clear Run Lake	200
Eagles Mere, Eagles Mere Lake	50
East Stroudsburg, McMichael Creek	125
Twelve Mile Pond	250
Ellwood City, Brush Creek	400
Conoquenessing River	400
Muddy Creek	400
Slippery Rock Creek	400
Ephrata, Conestoga Creek	125
Evans City, Conoquenessing River	600
Pennsylvania—Continued.	
Factoryville, Shibley Lake	512
Fleetwood, Maiden Creek	400
Fort Bigham, Tuscarora Creek	48
Frackville, Kauffmanns Lake	500
Mud Run Dam	250
Stoney Creek Pond	250
Gaines, Butternut Cove Pond	50
Harmarville, Red Raven Lake	12
Hawley, Fairview Lake	125
Jones Pond	125
Paupac Lake	125
Heart Lake, Heart Lake	125
Hopewell, Raystown Branch	200
Sideling Hill Creek	200
Indiana, Plum Creek, South Branch	400
Two Lick Creek	400
Jamestown, Shenango River	600
Jermyn, Heart Lake	125
Jersey Shore, Pine Creek	100
Susquehanna River	100
Kingston, Payne's pond	125
Sunset Lake	125
Kittanning, Allegheny River	400
Buffalo Creek,.	400
Cowanshannoc Creek	600
Crooked Creek	400
Lake Cary, Lake Cary	250
Latrobe, Nine Mile Run	400
Lebanon, Albert Pond	50
Harples Creek	50
Klines Pond	50
Laudermilchs Pond	50
Little Swatara Creek	50
Raccoon Creek	50
Stoevers Pond	50
Weidmans Pond	50
Lehighton, Mahoning Creek	125
Lewisburg, Buffalo Creek	100
Chilesquaque Creek	100
Little Buffalo Creek	100
Turtle Lake	100
Ligonier, Ligonier Ice Pond	200
Loyalhanna River	200
Lititz, Cocalico Creek	24
Conestoga River	96
Lock Haven, Bald Eagle Creek	80
Mahanoy City, Lakeside Lake	250
Marklesburg, Raystown Branch	450
Masthope, Forest Lake	72
Mifflinburg, Buffalo Creek	100
Penns Creek	200
Milton, Buffalo Creek	80
Susquehanna River, West Branch	80
Minersville, Pine Hill Pond	80
Rohersville Pond	80
Montoursville, Loyalsock Creek	100
Montrose, Elk Lake	125
Forest Lake	125
Heart Lake	125
South Pond	125
Moselem, Manatawney Creek	50
Tulpehocken Creek	50
Naomi Pines, Deep Lake	125
Newberry, Susquehanna River	35
Newcastle, Neshannock Creek	600
Slippery Rock Creek	600
Norristown, Perkiomen Creek	125
Oil City, Allegheny River	300
Allegheny River, Eagle Rock Eddy	400
Allegheny River, Hunters Eddy	400
Allegheny River, Oleopolis Eddy	400

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

LARGE-MOUTH BLACK BASS—Continued.

Disposition.	Fingerlings, yearlings, and adults.
Pennsylvania—Continued	
Pequea, Pequea Creek	33
Susquehanna River	132
Philadelphia, Fairmount Park Aquarium	15
Pittsburgh, Humphrey's pond	600
Pottsville, Kimbles Pond	40
Silver Creek Pond	40
Ramsey, Pine Creek	100
Ransom, Susquehanna River	375
Rauschs, Rauschs Dam	24
Reading, Tulpehocken Creek	100
Safe Harbor, Susquehanna River	132
Saxton, Raystown Branch	200
Shenango, Shenango River	600
Shenks Ferry, Susquehanna River	132
Somerfield, Youghiogheny River	800
Stewartstown, Hyson's pond	125
Yost's pond	125
Sunbury, Susquehanna River	260
Susquehanna, Susquehanna River	375
Taylorstown, Buffalo Creek	24
Thompson, Coxton Lake	375
Titusville, Oil Creek	600
Towanda, Susquehanna River	250
Tower City, Hoffmans Ice Pond	24
Patricks Ice Pond	24
Tunkhannock, Lake Sheridan	125
Susquehanna River	250
Uniondale, Lewis Lake	125
Waynesburg, Ten Mile Creek	800
Ten Mile Creek, Bates Fork	600
Ten Mile Creek, South Fork	1,600
Weissport, Pohopoko Creek	125
Westport, Kettle Creek	200
Wilkes-Barre, Nuangola Lake	125
Williamsburg, Juniata River, Frankstown Branch	400
Williamsport, Loyalsock Creek	80
Lycoming Creek	48
Winfield, Deep Creek	24
Penns Creek	48
Sweitzer Run	12
Wyalusing, Susquehanna River	125
Wyalusing Creek	125
Wysox, Lake Wesauking	125
Rhode Island:	
Harrisville, Herring Pond	200
Manville, Copper Hill Pond	150
Providence, Crescent Lake	150
Long Pond	200
South Carolina:	
Aiken, Crawford's pond	175
Holly's pond	175
Moseley's pond	175
Town Creek Pond	200
Whitlock's pond	175
Alcolu, Black River, Fork of	200
Anderson, Brogon Mill Lake	100
Causey's pond	100
Gray's pond	100
Norris's pond	100
Barnwell, Duncannon Pond	300
Batesburg, Forest Hill Pond	175
Belton, Belton Mills Pond	100
Bennettsville, Covingston's pond	120
Covington Pond No. 2	60
Bethune, Foard Lake	200
Watts's mill pond	100
Bishopville, Mill Pond	200
Watson's mill pond	200
Blacksburg, Kings Creek	200
Blackville, De Witt's pond	175
Turkey Creek	175
South Carolina—Continued.	
Blythewood, Bonney's pond	75
Bradley, Hickory Pond	200
Burton, Myrtlebush Pond	200
Camden, Factory Lake	200
Marego Mill Pond	100
Rush Lake	150
Watkins's pond	200
Cayce, Wilson's pond	175
Cheraw, Juniper Mill Pond	50
Little's pond	50
Spencer Mill Pond	50
Chesnee, Chesnee Mills Pond	100
Chesterfield, Gaddy Pond	50
Rivers's pond	50
Clover, Jackson's branch pond	200
Columbia, Adams Old Mill Pond	175
Albemarle Lake	100
Benge Pond	100
Gill Creek	200
Horseshoe Lake	200
Johniker Pond	175
Lott's Pond	100
Messers Mill Pond	100
Old Waterworks Reservoir	100
Spring Pond	100
Creston, Edwards's pond	200
Croft, Bridge Creek Pond	175
Plunkett Place Pond	175
Dalzell, Cherry Vale Pond	200
Jones's pond	200
Darlington, Coggeshall's pond	100
Little Lake	200
Donalds, Bubuda Pond	200
Locust Pond	200
Drake, Donaldson's pond	60
Edgefield, Clear Pond	175
Edmunds, Lucas's pond	175
Ehrardt, Clear Water Lake	28
Elko, Big Pond	400
Busby Pond	175
Fairforest, Moss Springs Pond	200
Florence, Black Creek	100
Fort Lawn, Catawba River	450
Fishing Creek	450
Fort Motte, McKenzie's pond	100
Gaffney, McKown Creek	100
Gantt, Myers's pond	200
Gaston, Rish's pond	175
Gilbert, Twelve Mile Creek	175
Govan, Stillwater Pond	200
Greenville, Arnold's pond	400
Reedy River Pond	600
Southern Power Co. Pond	200
Greenwood, Curtail Creek Pond	200
Curtail Creek Pond No. 2	200
Grendell Mill Reservoir	200
Watt Branch Pond	200
Grover, Gettys's pond	100
Hagood, Dinkins Mill Pond	100
Hilda, Watery Pond	175
Honea Path, Broadmouth Creek	200
Callahan's pond	100
Inman, De Shields's pond	200
Kershaw, Gardner's pond	200
Gardner's pond No. 2	100
Killian, Crain Pond	100
Stacker Mill Pond	75
Kinards, Dalrymple Pond	200
Lanford, Buck Head Creek	200
Enoree River	250
Todd Branch	200
Warrior Creek	200
Langley, Langley Pond	200
Laurens, Big Rabun Creek	300
Four Mile Creek	100

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

LARGE-MOUTH BLACK BASS—Continued.

Disposition.	Fingerlings, yearlings, and adults.
South Carolina—Continued.	
Laurens, Gray's lake	150
Horse Creek	200
Little River, Balls Fork	300
North Rabun Creek	200
Reedy River	350
Reedy River Mill Pond	150
Leesville, Hare's pond	1,500
Lightwood Pond	175
Marlow Pond	175
Smith's pond	200
Lexington, Barre's pond	175
Rocky Ford Mills Pond	175
McBee, Horton's pond	100
Monetta, Mill Creek	175
Mount Croghan, Lowry Brook	60
Neeses, Rocky Swamp Pond	200
Newberry, Bush River	200
North, Craft's pond	175
North Augusta, Butler's pond	175
Katlewood Oil Mill Pond	175
West View Pond	175
Olar, Big Salkehatchie River	300
Pageland, Graves's pond	60
Gulledge's pond	60
Knight's pond	60
Pelion, Fort's pond	175
Hollow Pond	175
Pinewood, Broughton's pond	600
Pomaria, Brick Pond	200
Hipp's pond	200
Race Lake	200
Rembert, Foxworth's pond	200
Smith's mill pond	200
Ridgeland, Mount Pleasant reserves	200
Ridge Spring, Bodie's pond	175
Cumbee's pond	175
Jordan's pond	175
Lots Pond	175
Rock Hill, Fishing Creek	200
Lockview Lake	100
Maple Hollow Pond	100
Poag's mill pond	100
South Fork Creek	100
Stony Fork Creek	100
Rockston, Estes's pond	75
Ruby, Cruses Branch Pond	50
St. Matthews, Antley's pond	100
Gressette's pond	100
Hane's pond	200
High Hill Creek	100
Smoke's pond	100
Salley, Cooper's pond	175
Dean Swamp Creek	200
Williamson's pond	175
Saluda, Saluda River	1,600
Sandy River, Seley Creek	200
Sanford, Suggs's mill pond	200
Scotia, Davis's pond	175
Seivern, Rawls's pond	350
Spartanburg, Fairmont Pond	1,800
Irwin's pond	400
McAbee's pond	200
Middle Tyger River	400
Springfield, East Rocky Swamp Pond	200
Starr, Spring Branch Pond	100
Steedman, Barr Pond	300
Lightwood Knot Creek	300
Summerton, Pine Grove Pond	200
Sumter, Black River	400
Du Rant's pond	200
Ostern's mill pond	200
South Carolina—Continued.	
Sumter, Second Mill Pond	200
Swansea, Big Sandy Pond	350
Bull Swamp Pond	200
Martin's pond	200
Tirzah, Wallace's pond	200
Trenton, Baynhams Pond	1,250
Bettis's pond	175
Blue Ridge pond	175
Carolina asparagus farm pond	175
Croft Pond	175
Hughes's pond	175
Miles's mill pond	175
Miller's pond	175
Quarles Pond	175
Silver Pond	175
Vancluse Pond	175
Wise's pond	175
Troy, Goff's pond	200
Ulmers, Pretty Creek Pond	350
Union, Oak Hall farms pond	200
Vaucluse, Steele's pond	175
Wagener, Gunter's pond	350
Walhalla, Tamasse Creek	400
Verner's pond	100
Village Creek	100
Wedgefield, Shawk's pond	200
Wellford, North Tyger River	1,000
Tucapau Pond	200
Williamston, Saluda River	200
Willington, Little River	200
Windsor, Bates's pond	175
Long Branch Pond	175
Seigler's pond	175
Winnsboro, Allens Pond	75
Little River	150
Yemassee, Back Water Pond	200
Capon Corner Pond	200
Walnut Hill Pond	200
South Dakota:	
Aberdeen, Lake Minneeho	46
Arlington, Poinsett and Dry Lakes	20
Bellefourche, Bellefourche Lakes	20
Fisher Pond	10
Orman Lake	20
Belvidere, Tjaden's lake	100
Chamberlain, Missouri River, tributary of	200
Conata, Conata Pond	50
Huron, Lake Byron	60
Interior, Corn Creek	50
Watkins's lake	100
Kennebec, Cottonwood Pond	100
Grouse Creek	100
Olson's pond	100
McCook, McCook Lake	300
Madison, Lake Herman	500
Lake Madison	600
Midland, Delans Pond	50
Hedman's pond	50
Kiser Township Pond	50
Piersall's lake	50
Mitchell, James River	245
Parkston, James River, above dam	200
James River, below dam	200
Lake Artlison	200
Twelve Mile Creek	200
Platte, Norbeck's pond	100
Quinn, Sunnyslope Lake	50
Ree Heights, Wolf Creek	50
Vermilion, Vermilion River	300
Volga, Lake Tetonkeha	70
Woonsocket, Schroeder's lake	100

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

LARGE-MOUTH BLACK BASS—Continued.

Disposition.	Fingerlings, yearlings, and adults.
Tennessee:	
Athens, Adams's pond	30
Bolivar, Galloway's pond	150
Chattanooga, Steward Lake	12
Clarksville, Red River	360
Cleveland, Lake Ocoee	12
Del Rio, French Broad River	250
Halls, Goodwin's pond	100
Hatchie, Murdock's lake	200
Knoxville, Holston River	20
Little Pigeon River, West Fork	20
Tennessee River	30
Lawrenceburg, Crowson Creek	200
Crowson Mill Pond	200
Shoal Creek, North Prong	100
Shoal Creek, South Prong	100
Stockard's pond	150
Waterworks Pond	200
Mount Pleasant, Cecil's pond	100
Nashville, Davidson Lake	150
Shelby Park Lake	300
Newport, Big Pigeon River	250
Peryear, Obion Creek, North Fork	300
Rives, Wadelock Pond	150
Saulsbury, Moore's pond	200
Tate, German Creek	52
Waverly, Hurricane Creek	650
Texas:	
Alba, Dale Creek Club Lake	2,000
Allen, Bush Pond	1,200
Cottonwood Pond	1,200
Alto, Sycamore Lake	1,000
Amarillo, Horsbrugh's pond	750
Annona, Clear Lake	165
Athens, Deen's pond	750
Lehr's mill pond	2,000
Macks Pond	750
Wood's lake	1,500
Arlington, Beasley's pond	1,000
Lee's lake	2,000
Arp, Gum Lake	1,000
Aspermont, Sellers's pond	800
Bailey, Portland Pond	500
Baird, Hatchett's pond	2,700
Beckville, Willow Lake	600
Ben Franklin, Oak Dale Lake	400
Benjamin, Red Draw Pond	81
Bergs Mill, Dullnig's lake	1,000
Big Lake, Tuesdale Spring Pond	600
Boerne, Cibolo Creek	1,200
Bonham, Bonham Country Club Lake	1,600
Bonham Country Club Pond	800
Bowman's lake	1,000
Boyd Lake	1,300
Halsell's pond	800
Brady, Harkrider's pond	200
Brenham, Club Lakes	525
Bronson, Huffman's pond	285
Bronte, Luna Lake	800
Brownwood, Baughs Lake	2,000
Brownwood Club Lake	4,000
Cloverdale Lake	1,000
Shepards Lake	2,000
Wood's pond	1,000
Bryan, Dansby's lake	225
Oak Woods Lake	150
Burton, Bradfield Mill Pond	600
Caldwell, Elizabeth Lake	75
Cameron, Batt's lake	75
Canadian, Coburn Pond	1,600
Russ's pond	1,600
Catarina, Live Oak Lake	3,000
Texas—Continued.	
Center, Bailey's pond	850
Pearce's pond	600
Sweet Bay Pond	600
Wood Lake	1,680
Center Point, Guadalupe River	2,400
Chandler, Flag Lake	50
Childress, Lake Keeloer	2,100
South City Lake	1,400
Terrell Lake	650
Clarendon, Spring Creek	750
Clarksville, Country Club Lake	1,800
Clyde, Johnson Lake	2,700
Coahoma, Lacy Pond	900
Colorado, Turner's pond	900
Coolidge, Askew's pond	75
Coolidge Pond	150
McCoy's pond	200
Cooper, Edgewood Park Pond	240
Corsicana, Beaton's pond	1,200
Brick Company Pond	605
Frost Pond	1,000
Interurban Pond	600
Navarro Club Pond	1,200
Read Pond	1,000
Coupland, Holman's pond	1,000
Crockett, Thompsons Lake	1,000
Cross Plains, Newton Lake	185
Crowell, Bell's pond	333
Bell's pond No. 2	675
Bell's pond No. 3	333
Crystal City, Masterson's pond	1,550
Dallas, Bachman Creek	100
Country Club Lake	1,000
Dallas Country Club Lake	1,890
Trinity Lake	3,000
Del Rio, Cienegas River	2,400
Devils River	3,000
Pinto Creek	2,400
San Felipe Creek	2,400
Sycamore Creek	2,400
Denison, Shawnee Lake	2,000
Waterloo Pond	3,000
Devine, Burns Boat Pond	650
Diboll, Everglade Pond	300
Dilley, Edwards's pond	500
Edna, Allen Lake	3,600
Dunlap Lake	2,700
Kerr Lake	3,500
Elgin, Harris Lake	50
Raemer's lake	50
Standfield's pond	50
Ennis, Farrar Pond	1,200
Farris Pond	600
Herron's pond	600
Moore Lake	600
New Lake	2,400
Old Lake	2,400
Falfurrias, Donohoe's pond	500
La Nopalera Lake	500
Oklahoma Farm Pond	520
Ferris, Gravel Slough Lake	1,200
Floyd, Ballast Pond	3,000
Blakemore Lake	1,000
Forney, Lone Elm Pond	1,000
Fort Stockton, Leon Creek	1,200
Fort Worth, Debeque Lake	66
Duringer Lake	1,058
Fossil Lake	1,000
Lake Worth	5,525
Martins Lake	1,925
Trinity River, Clear Fork	3,600
Fouke's spur, Fishing Club Lake	2,400
Peacock's pond	1,000
Frankston, Plainview Lake	1,800

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

LARGE-MOUTH BLACK BASS—Continued.

Disposition.	Fingerlings, yearlings, and adults.
Texas—Continued.	
Freeport, Sulphur Pond	1,225
Frost, Frost Lake	150
Frost Lake No. 2	75
Gainesville, Club Lake	280
Country Club Lake	280
Elm Creek	280
Jones Lake	280
Lindale Lake	265
Little Club Lake	1,065
Sarles Lake	280
Garland, Lyles Pond	1,000
Gilmer, Willow Dale Pond	1,500
Gonzales, Ramshell's pond	1,000
Goodnight, Spring Creek Pond	650
Goree, Rich Lake	800
Gorman, Eppler Lake	500
Granbury, Lambert Branch	550
Grand Prairie, Gains's lake	1,000
Horseshoe Lake	1,000
Midway Farm Lake	1,000
Grand Saline, Harn's lake	1,000
Grapeland, Gibson's pond	50
Stafford's lake	1,000
Greenville, Brushy Lake	100
Creek Pond	100
Greenville Lakes	3,600
King Lake	100
Mineral Heights Lake	250
Rutherford Lake	100
Groesbeck, Stroud Lake	1,200
Handley, Edrington's pond	1,000
Harleton, Lake Windham	2,400
Harrison Switch, Elm Lake	2,600
Harrold, Wolf's pond	558
Haskell, Bachman's pond	700
Bachman's pond No. 2	700
Hog Creek	1,600
King's pond	800
Marlin's pond	700
Ranger Creek	2,600
Heidenheimer, Wedel's pond	70
Henderson, Pool's pond	700
Hillsboro, Ellington's lake	660
Hillsboro Lake	2,000
Honey Grove, Holts Heights Lakes	850
Houston, Rudnick's pond	305
Silver Lake	450
Hubbard, Beasley's pond	1,200
Beasley's pond No. 2	1,000
Club Lakes	3,000
Downey Branch Pond	1,200
Johnson's pond	1,200
McGuffey's pond No. 1	1,000
McGuffey's pond No. 2	1,000
McGuffey's pond No. 3	1,000
Matson's pond	1,200
Pin Oak Pond	1,200
Waterworks Ponds	4,500
Hutchins, New Fin and Feather Lake	2,400
Vining Lake	2,400
Iredell, Placid Pond	78
Itasca, Bumble Bee Lake	500
Jefferson, Lake Bruce	2,400
Josephine, Yeatts's pond	500
Kaufman, Cartwright's pond	2,000
Friends Lake	400
Gilmore Pond	175
Kemp, Erna Lake	2,000
Longs Lake	2,000
Still's pond	1,000
Tate's pond	1,000
Kerrville, Autry's pond	120
Bonnebel Lake	3,970
Council Pond	50
Texas—Continued.	
Kerrville, Crider Pond	60
Hope's pond	120
Johnson Fork Creek	120
Keiser Pond	120
Kelly Creek Pond	120
Lake Lee	50
Medina River	120
Paint Creek Pond	50
Ragland Lake	120
Real Lake	60
Schreiner Lake	120
Sherman Pond	120
Storkey Pond	60
Sublett Pond	60
Wachter Pond	120
Kingsville, Cross Lake	307
Ladonia, Ladonia Cotton Oil Company Pond	400
Ladonia Electric Company Lake	400
Pecan Gap Lake	400
Lampasas, McCombs Pond	2,400
Lancaster, Lancaster Country Club Lakes	2,400
Las Vegas, Las Vegas Pond	370
Lawn, Railroad Lake	3,600
Lexington, Salt Lake	2,320
Linden, Sheffield's pond	1,200
Llano, Jackson Pond	600
Longview Junction, Campbell-Morgan Lake	3,600
Loraine, Hart's pond	50
Mathews Pond	1,800
Lufkin, Bonner's pond	100
Lytle, Brattle Reed Pond	50
McCoy, McGehee's pond	726
McLean, Kibler Lake	700
Mabank, Ackers Lake	1,000
Garner Lake	2,000
Guile's pond	700
Hern Pond	700
McKee's lake	700
McKee's pond	700
McNutt's pond	500
McShan's pond	800
Osborne's pond	700
Rice Pond	700
Valley Ranch Pond	700
Walter Allen Pond	500
Wind Mill Pond	800
Manor, Hulin Springs Pond	600
Menefee's pond	600
Marathon, Maravillas Creek	2,400
Pena Colorado Creek	2,400
Marfa, Lake Colpitts	2,400
Marion, Cibolo Ponds	3,000
Cibolo River	470
Marshall, Clear Water Lake	3,400
Lake Fern	3,400
Megargel, Lake McCarty	400
Menard, Callan Lake	1,175
Celery Creek	2,400
Mendota, Herford Lake	420
Meridian, Johnson's pond	125
Mertzon, Dove Creek	2,250
Spring Creek	2,300
Mesquite, Duff Lake	1,080
Mexia, Everett's pond	75
Kennedy's pond	75
Mineral Wells, Eagle Creek	734
Monte Christo, Melado Land Company Pond	140
Mount Vernon, Holcomb's pond	500
Jordan & Douglas Pond	500

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

LARGE-MOUTH BLACK BASS—Continued.

Disposition.	Fingerlings, yearlings, and adults.
Texas—Continued.	
Nacogdoches, Masts Creek	2,400
Sanders Branch	1,200
Stallings's pond	450
Naples, Floyd Pond	2,000
Moore's lake	2,000
Milner Pond	1,100
Napona Lake	3,000
Ozella Lake	2,000
Spence's pond	2,000
Navarro, Tatum Lake	75
New Braunfels, Bear Creek	180
Comal River	3,535
Guadalupe River	275
Newville, Peacock's pond	600
New Waverly, Emma Pond	225
Palestine, New Kirk Lake	1,000
Redwine's lakes	4,100
Paris, Clear Lake	150
Gordon Country Club Lake	1,275
Lake Gorham	165
Loraine Pond	165
Williams's pond	1,200
Williams's pond No. 2	165
Pinehill, Stone's pond	550
Pittsburg, Heath's pond	1,000
Reaves Club Lake	700
Plainview, Pioneer Park Lake	1,400
Plano, Spring Creek	1,500
Point, Gin Pond	1,000
Robb's pond	1,000
Robison's pond	1,000
Simmons's pond	1,000
Post, Two Draw Lake	1,800
Poteet, Heinen's pond	100
Pritchett, Baird Lake	75
Pankey's lake	75
Pankey's pond	650
Purdon, Johnson's pond	1,000
Quinlan, Sycamore Pond	1,200
Ragley, Ragley Pond	475
Ranger, Palo Pinto Lake	116
Willow Pond	900
Reagor, King Lake	250
Red Lawn, Tullis Lake	2,000
Rhonesboro, Brown's lake	700
Rice, Edmundson Lake	600
Richardson, Campbell's pond	1,200
Rising Star, "O" Ranch Pond	310
Riviera, Penantly Lake	140
Rochelle, Sellman Lake	200
Sabinal, Sabinal River	2,000
San Angelo, Concha River, Johnsons Dam	81
Motel Lake	81
Waterworks Pond	318
San Antonio, Lower Salado Creek	450
Medina Valley Pond	7,000
San Antonio River	10,475
Six Mile Creek Pond	1,275
Southton Lake	439
Suden's lake	3,068
West End Lake	660
San Benito, Novotny's lake	810
San Marcos, San Marcos River	4,600
San Saba, Estep Lake	260
Santa Anna, Banister Lake	1,175
Schertz, Cibolo Creek	4,000
Scurry, Bass Lake	400
Seguin, Guadalupe River	5,900
Shepherd, Fish Branch	1,200
Sherman, Shannon Farm Lake	1,400
Shiro, Ten Oak Pond	125
Sipe Springs, Leonard Pond	500
Slaton, Yellow House Creek	2,630
Smithville, Gilbert's pond	600
Texas—Continued.	
Stamford, Hisey Lake	800
Railroad Lake	800
Stovall Lake	1,600
Stewerton, Cherryhomes's pond	300
Sunny Brook Pond	300
Strawn, Cat Tail Lake	900
Rochell's lake	900
Streetman, Stewards Mill Lake	300
Sulphur Springs, Brinker's pond	1,439
Elberta Lake	1,200
Lake Coleman	410
Plemmon's lake	700
Sweetwater, Plum Lake	1,800
Taylor, Burns Lake	1,000
Klaus's pond	2,000
Taylor City Lake	2,400
Water Company Reservoir	1,000
Temple, Lake Polk	3,725
Terrell, Allen's pond	300
Butler Lake	1,200
Cartwright's pond	1,200
Corley's pond	150
Elks Lake	1,200
Hardin's lake	150
Lumpkin's pond	1,200
Martin's pond	1,200
Noble's pond	150
Overton's pond	1,200
Texarkana, Temple Lake	3,000
Thorndale, Winter's pond	150
Thornton, Eproson's lake	600
Thrall, Douglas's pond	2,000
Johnson's pond	2,000
Timpson, East Texas Fair Lake	1,000
Samford's lake	900
Witcher's pond	200
Truscott, Bell Pond	1,175
Cedar Lake	87
China Lakes	1,133
Clear Rock Pond	90
Jerrys Lake	81
Quail Lake	81
Tyler, Fresh Pond	800
Uvalde, Franklin's pond	1,000
Leona River	3,000
Nueces River	1,000
Nueces River, lower	3,000
Seco Frio River	2,000
Valentine, Quinn's pond	1,200
Van Alstyne, Van Alstyne Lake	2,400
Vernon, Cedar Bluff Pond	1,300
East Lake	750
Pease River Pond	650
Waco, Bosque Lake	550
Oak Lake Pond	1,000
O'Connell Lake	814
Thagard's pond	1,000
Waco Creek	4,000
Waxahachie, Country Club Lake	2,000
Weimar, Mozisek's pond	130
Wills Point, Home Lake	2,400
Winfield, Powers's lake	500
Woodville, Pope's pond	200
Yoakum, East Brushy Pond	955
Yorktown, Smith Creek	2,235
Vermont:	
Bloomfield, Wheeler Pond	91
Fairlee, Lake Morey	80
Island Pond, Railroad Pond	90
Lyndonville, Chandler Pond	89
Walden, Cole's pond	60
Virginia:	
Abingdon, Holston River, Middle Fork	225
Ashburn, Goose Creek	36

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

LARGE-MOUTH BLACK BASS—Continued.

Disposition.	Fingerlings, yearlings, and adults.
Virginia—Continued.	
Barren Springs, Reed Creek	200
Baskerville, Edam's pond	400
Bedford, Big Otter River	200
McGhee's pond	1,000
Blacksburg, Henderson's pond	100
Buchanan, James River	48
Buffalo Junction, Aarons Creek	400
Pittard Pond	200
Byllesby, New River Pond	300
Clifton Station, Bull Run	48
Cobham, Cobham Park Pond	12
Covington, Dunlap Creek	12
Jackson River	12
Potts Creek	12
Danville, Dan River	400
Edinburg, Shenandoah River, North Fork	36
Elliston, Roanoke River, North Fork	3,000
Roanoke River, South Fork of	3,000
Emporia, Beaver Pond	400
Fredericks Hall, Lake Sherman	300
Fries, Peach Bottom Creek	900
Front Royal, Shenandoah River	12
Goode, Wood's pond	100
Gordonsville, Mountain View Pond	200
Hanover, Mt. Pleasant Pond	12
Harrisonburg, Shenandoah River	12
Hewlett, Offley Mill Pond	12
Hollins, Carvins Creek	4,000
Houston, Gates Mill Pond	24
Johnson's pond	36
Howardsville, Dornoch Pond	1,000
Sunny Side Pond	3,000
Keswick, Crawford's pond	12
Leesburg, Caradoc Lake	144
Tuscarora Creek	24
Louisa, Bucks Pond	36
Low Moor, Pike Pond	12
Marion, Holston River, Middle Fork	225
Maurertown, Shenandoah River, North Fork	12
Millboro, Cow Pasture River	12
Wallawhatoola River	12
Nelson, Thames's pond	400
Norfolk, Norfolk City Lakes	60
Orange, Anna River, North Fork	300
Marshalls Pond	12
Mountain Run	48
Palmyra, Montevale Pond	36
Rivanna River	144
Pembroke, Mountain Lake	150
Port Republic, South River	36
Richmond, Cooks Mill Pond	36
Scherer's pond	135
Waterview Mill Pond	360
Watkins Mill Pond	150
Westham Country Club Pond	75
Roanoke, Tinker Creek	200
Scottsville, Albevanna Pond	12
South Richmond, Falling Creek	375
Stewarts Wharf, Masons Mill Pond	24
Valentines, Fair Oaks Lake	400
Warren, Baber's pond	2,000
Waterlick, Passage Creek	12
Woodslane, Mattaponi River	12
Wytheville, Reed Creek	200
Reed Creek, headwaters	200
Washington:	
Cloverland, Cloverland Lakes	200
Newport, Bead Lake	100
Long Lake	100
Orient, Carls Lake	30
South Bend, Giles Lake	....
West Virginia:	
Beury, New River	475
Burnsville, Little Kanawha River	600
Gilmer, Little Kanawha River	600
Neola, Anthony's Creek	400
Ronceverte, Greenbrier River	600
Shelton, Kanawha River	800
Walkersville, Monongahela River, West Fork	600
Wisconsin:	
Barneveld, Jones Valley Creek	600
Oirnoen Creek	400
Williams Creek	400
Barronett, Lake Thirty Two	300
Bloomer, Shattuck Lake	300
Boyd, Big Drywood Creek	200
Pike Lake	400
Yellow River	500
Chetek, Mud Lake	300
Colfax, Lake Colfax	400
Cumberland, Bass Lake	200
Beaverdam Lake	100
Buck Lake	100
Crystal Lake	100
Dummy Lake	100
Echo Lake	100
Horseshoe Lake	100
Kirby Lake	100
Spring Lake	100
Devils Lake, Devils Lake	390
Fond du Lac, Lake de Neveu	500
Long Lake	600
Mullet Lake	500
Grand Rapids, Wisconsin River	400
Hayward, Callahan Lake	100
Chief Lake	100
Clear Lake	100
Crane Lake	100
Ghost Lake	100
Glover Lake	100
Grindstone Lake	100
Lake Court O'Reilles	200
Lost Lake	100
North Lake	100
Round Lake	100
Smith Lake	100
Spider Lake	100
Squaw Lake	100
Teal Lake	100
Twin Lakes	71
Williams Lake	200
Hudson, Coon's pond	200
Willow River	200
Johnson Creek, Johnson Creek Pond	200
La Crosse, Bank Slough	100
Black Snake Slough	200
Broken Gun Slough	150
Dam No. 41	200
French Slough	200
Lytles Bay	200
Running Slough	200
Swift Slough	150
Taylor Slough	100
Wigwam Slough	100
Lake Beulah, Lake Beulah	400
Lyndhurst, Big Lake	100
Island Lake	100
Shingleland Lake	100
Slingersland Lake	100
Ward Pond	100
Manitowoc, Hartlaubs Lake	400
Hemptons Lake	400
Kastbaums Lake	400
Merrill, Bass Lake	50
Lake View	50
Seven Island Lake	50

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

LARGE-MOUTH BLACK BASS—Continued.

Disposition.	Finger-lings, yearlings, and adults.
Wisconsin—Continued.	
Mosinee, Wisconsin River	225
Norrie, Lake Go To It	200
North Prairie, Heintz & Jacobs's lake	400
Okauchee, Okauchee Lake	800
Pewaukee, Pewaukee Lake	400
Richland Center, Bowens Mill Pond	250
Pine River	225
Sayner, Bear Lake	100
Clear Lake	100
Hobo Lake	100
Little Bass Lake	100
Lost Lake	100
Muscallonge Lake	100
Stella Lake	100
Schleisingerville, Cedar Lake	400
Sheboygan Falls, Sheboygan River	400
Stanley, Brown Lake	200
Yellow River	300
Star Lake, Ballard Lake	100
Taylor, Trempeleau River	200
Tomahawk, Cass Lake	100
Half Moon Lake	100
Lake Clara	100
Manson Lake	100
Muskellunge Lake	100
Mystic Lake	100
Road Lake	100
Somo Lake	100
Tomahawk River	100
Twin Lakes	100
Wisconsin River	100
Trevor, Rock Lake	400
Wausau, Bass Lake	100
Big Eau Pleine River	200
Eau Claire River	200
Half Moon Lake	75
Lake Mosinee	200
Lake Wausau	200
Mayflower Lake	200
Wisconsin—Continued.	
Wausau, Short Portage Lake	100
Wisconsin River	200
Whitewater, Green Lake	400
Lauderdale Lake	400
Middle Lake	400
Turtle Lake	400
Whitewater Lake	400
Wonewoc, Alcott Creek Slough	100
Baraboo River	150
Baraboo River, East Branch	200
Baraboo River, West Branch	150
Beaver Creek Slough	100
Castle Rock Slough	100
Crawfish Slough	100
Fix Slough	100
Foxal Slough	100
Milhbaurers Slough	100
Mill Pond	100
Mud Turtle Slough	100
Orin Hill Slough	100
Peters Slough	100
Rogers Pond	100
Rohlings Slough	100
South Branch Creek	100
Starkeys Slough	100
Tank Slough	100
Twin Bluff Slough	100
Wests Slough	100
Wolfendens Slough	100
Wyoming:	
Cheyenne, Sloans Lake	30
Opal, Smith Lake	30
Rawlins, Separation Lake	30
Sheridan, Smiths Lakes	100
Total[a]	822,650

SUNFISH (BREAM).

Alabama:	
Abbeville, Arnold Lake	100
Choctawhatchee River	400
Doswell's lake	108
Holland Mill Pond	100
Kirkland's pond	200
Poor Creek	200
Allenton, McWilliam's pond	100
Andalusia, Clark's pond	154
Berry, Oswalt's pond	400
Billingsley, Cherry's pond	400
Birmingham, Grasselli Pond	100
Blocton, Pratts Creek	200
Schultz Creek	200
Brewton, Bassett's pond	100
Brundige, Copers Pond	77
Wilkin's pond	77
Camden, Bonner Lake	100
Capps, McClellan's pond	77
Castleberry, Lee's pond	100
Childersburg, Lee's pond	100
Clanton, Mims's pond	100
Coxs Mill Pond	100
Floyd's pond	200
Greene's pond	200
Johnson's pond	100
Martin's pond No. 1	200
Martin's pond No. 2	200
Norton's pond	100
Alabama—Continued.	
Comer, Pruett Pond	100
Dothan, Farmer's pond	77
Elamville, Ketcham's pond	100
Sutton's pond	100
Teal's pond	100
Elba, Bragg's pond	77
Comer Mill Pond	77
Davis Mill Pond	77
Donaldson's pond	154
Franklin Pond	77
Lake Donaldson	77
Lee's mill pond	77
McGinty's pond	77
Marlor's pond	77
Morrow's mill pond	77
Murphree Pond	77
Pea River	77
Rowes Mill Creek	77
Thompson's pond	77
Enterprise, Heath's pond	77
Meredith's pond	154
Spring Pond	77
Eufaula, Engram's pond	100
Mills Lake	100
Evergreen, Dale Creek, headwaters	400
Fayette, Shepherd's pond	100
Smith's pond	100
Spiller's pond	100

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[a] Lost in transit, 20,906.

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

SUNFISH (BREAM)—Continued.

Disposition.	Finger-lings, yearlings, and adults.
Alabama—Continued.	
Forney, Spring Creek	300
Fort Deposit, Black's pond	100
Fort Payne, Pine Grove Pond	100
Gadsden, Nocealula Pond	400
Girard, Humber's pond	100
Goodwater, Deason Lake	100
Grimes Pond	100
Hatchet Creek	100
Wildcat Creek	100
Goshen, Copeland Spring Pond	77
Paul's pond	77
Paul's pond No. 2	77
Greenville, Thrasher's pond	400
Guntersville, Forest Pond	100
Hartford, Daughtry Pond	154
Martin's pond	77
Headland, Brackin's pond	100
Brackin's pond No. 2	100
Brackin's pond No. 3	277
Spring Branch Pond	77
Mathis's pond	100
Oates's pond	77
Phillips's pond	77
Hooks, Perry's pond	100
Huntsville, Indian Creek	900
Jemison, Glascock's pond	150
Jones, Sycamore Lake	100
Keystone, Bowdon's pond	100
Kinston, Branch Pond	77
Letohatchee, Alexander Pond	100
Guy's pond	100
Lineville, Russell's pond	100
Luverne, Kendrick's pond	77
Melborne, Hays's pond	100
Merry, Handey's pond	100
Midland City, Herring Spring Pond	77
Millport, Hightogy Pond	100
McDaniel's pond	200
Montgomery, Excelsior Pond, east	250
Todd's lake	100
Opelika, Orr's pond	100
Sandford Spring Branch	100
Opp, Richardson's pond	77
Phil Campbell, Cofield's pond	100
Lambert's pond	150
Maple Pond	100
Nix Branch	100
Roanoke, Benefield's pond	100
Johnson's pond	100
Russellville, Burgess's pond	100
Lake Henry	200
Seale, Dudley's pond	200
Treadway's pond	100
Sellers, Bedsole's pond	77
Selma, Orchard Lake	100
Shellhorn, Belser & Cochran's pond	77
Shorters, Smith's pond	100
Tredegar, Ledbetter's pond	250
Troy, Ballard's pond	150
Barnett's pond	150
Black's pond	300
Blair's pond	150
Bryan's pond	77
Copeland's pond	77
Dickinson's pond	150
Flowers's pond	150
Hills Branch Pond	150
Jones's pond	150
Rhodes's pond	150
Spring Branch Pond	150
Swain's pond	77
Youngblood Pond	77
Tuskaloosa, Herman's pond	200
Quarles Lake	400
Tyson, Railroad Pond	100
Alabama—Continued.	
Uniontown, Glass's pond	100
Valley Head, Town Creek	450
Wadley, McGill's pond	200
White Oak, Turner's pond	400
Whitney, Ashville Lake	100
Arizona:	
Holbrook, Lyman Reservoir	400
Arkansas:	
Abbott, Morgan's pond	100
Blevins, Hopkins's pond	200
Cushman, Denison's pond	150
Hope, Budwell's pond	550
Johnson, Stuckey's pond	100
Magnolia, Dennis's pond	100
Eubank's pond	200
Heath's mill pond	100
Mammoth Spring, Richardson Pond	310
New Edinburgh, Clements's pond	100
Prescott, Brandon's pond	150
Womble, Caddo River	300
Colorado:	
East Lake, Schradsky's lake	300
Connecticut:	
Greenwich, Bolling's pond	300
District of Columbia, Rock Creek	300
Twin Lakes	800
Florida:	
Jasper, Barschampie Lake	600
Georgia:	
Albany, Kinchafoone Creek	500
Muckalee Creek	800
Andersonville, Gwynes's pond	100
Athens, Oconee River	225
Atlanta, Capitol Aquarium	50
Germania Lake	150
Lombard's pond	400
Spring Lake	150
Augusta, Big Spirit Creek	300
Butlers Creek	1,000
Bartow, Etheridge's pond	150
Broxton, Byrd's pond	250
Graham's pond	100
Leggett's pond	100
Lewis's pond	200
Buena Vista, Clements's pond	300
Lanahassie Creek Lake	200
Muckalee Creek Pond	200
Buford, Pass's pond	100
Bullochville, Smith's pond	250
Carrollton, Reagin's pond	600
Cedartown, Hunt's pond	100
Clarkston, Sams's pond	200
Comer, Hutchinson's pond	100
Commerce, Bowden Branch Pond	200
Coolidge, Murphy's pond	300
Cuthbert, Seven Head Stream	400
Cycloneta, Cycloneta Pond	200
Daisy, De Loach's pond	200
Danville, White's pond	200
Dawson, Riley's pond	100
De Soto, Ferguson's pond	100
Devereux, Bass's pond	75
Dexter, Daniel's pond	200
Durand, Tignor's pond	100
Ellaville, Green's pond	200
Fitzgerald, Paulk's pond	300
Fitzpatrick, Lake Fleta	100
Fort Valley, Hartley's pond	100
Neil's pond	200
Gibson, Walker's pond	225
Gray, Smith's pond	200
Griffin, Grantland's pond	200
Towaliga Falls Pond	200
Harlem, Hubbard's pond	200
Harris, Caldwell's pond	200

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

SUNFISH (BREAM)—Continued.

Disposition.	Finger-lings, yearlings, and adults.
Georgia—Continued.	
Hartwell, Turner's pond	200
Howard, Brown's pond	200
Huntington, Po Jo Lake	400
Irwinville, Clements's pond	200
Jefferson, White's pond	200
Williams's pond	150
Jonesboro, Cousins Pond	200
Kathleen, Small's pond	200
La Grange, Callaway's pond	250
Lake Park, Ocean Pond	400
Lavonia, Cothran's pond	200
Lizella, Redding's pond	200
Macon, Brundage's pond	150
Masonic Home Pond	200
Rose Hill Lake	200
Madison, Hagg Pond	200
Houghton Pond	200
Mirror Pond	200
Marshallville, Vining Mill Pond	200
Martin, Garner's pond	200
Metter, Dixon's pond	375
Milledgeville, Carmanee Pond	150
Cox's pond	150
Millen, Ogeechee River	300
Mitchell, Jose Creek	150
Morven, Duckworth's pond	200
Newman, Pearl Spring Lake	815
Norwood, Anderson's pond	200
Duckworth's pond	100
Howell's pond	100
Ray's pond	475
Reese's pond	150
Swain's pond	750
Sweetwater Pond	100
Ochlochnee, Grass Pond	150
Plains, McGarrah's lake	300
Raton Gap, Masingill Pond	200
Renfroe, Shady Pond	100
Rhine, Willcox's pond	300
Richland, Dixon's pond	100
Roswell, Broadwell's pond	300
Parker's pond	200
Savannah, Herb River, branch	350
Shellman, Hay's pond	300
Sears's pond	200
Trippe's pond	300
Smithville, Muckaloochee Creek Pond	300
Soperton, Moxley's pond	100
Swainsboro, Little Choopee River	400
Talbotton, Wilson Creek	200
Tallulah, Hughes's pond	200
Thomaston, Gin Pond	200
Thomasville, Aolian Pond	75
Avera's pond	75
Bulloch's pond	200
Country Club Pond	150
Olena Pond	200
Trout Lake	100
Willow Lake	150
Toccoa, Garner's pond	300
Varnells, Fagola Pond	100
Vidette, Black Jack Pond	300
Walls Crossing, Snider's pond	100
Washington, Willis's lake	100
Waynesboro, Buckhead Creek	275
Rocky Creek	275
Winterville, Hawkes's pond	100
Woodbury, Fruit Haven Farm Pond	200
Yatesville, Crawford's pond	75
Illinois:	
Casner, Myers's lake	200
Dunning, Chicago State Hospital Pond	200
Edwardsville, Locust Hill Lake	100
Effingham, Van Camp Pond	200
Illinois—Continued.	
Marshall, Crystal Lake	200
Meredosia, Meredosia Bay	100
Mississippi River	13,465
Indiana:	
Lebanon, Allen Pond	150
Flora Pond	150
Lewisville, Griffin's pond	100
Marion, Mississinewa River	150
Morris, Pohlar's pond	150
Muncie, Parkison's quarry pond	200
Odon, Persimmon Pond	100
Shelbyville, Morris's pond	200
Topeka, Atwood Lake	180
Dallas Lake	180
Pickerel Bay Pond	180
Iowa:	
Bellevue, Mississippi River	48,000
North McGregor, Mississippi River	154,000
Randall, Little Wall Lake	200
Kansas:	
Olathe, Hoff's pond	150
Penokee, Kobler's pond	100
Scott City, Wilken's pond	100
Kentucky:	
Avenstoke, Smith's pond	100
Bardstown, Lancaster Lake	100
Bowling Green, Ewing Ford Pond	200
Gasper River	100
Brandenburg, French's pond	400
Danville, Roberts Pond	100
Robinson's pond	100
Erlanger, Kircher's pond	100
Georgetown, Brown's pond	300
Glasgow, Beebe's pond	200
Hays's pond	400
Greenville, McClellan's pond	300
Guthrie, Rural Rest Pond	100
Louisville, Lake Lansdowne	200
Munfordville, Farm Pond	200
Nazareth, Trinity Lake	100
Paris, Elgin's pond	100
McCandless's pond	100
McShane's pond	100
Moss's pond	100
Thomas's pond	100
Weisberg's pond	100
Louisiana:	
Athens, Harris's pond	200
Jonesboro, Maxwell's pond	400
Natchitoches, Blue Lake	600
Cook's lake	400
Lake Marie	600
Live Oak Lake	600
Murphy's pond	600
Normal Lake	400
Pratt's lake	600
New Orleans, Soldiers Home Pond	200
Quitman, Barnard's lake	400
Robeline, Page's pond	200
Slidell, Peterson's pond	400
South Mansfield, Club Pond	200
Williams Lower Pond	200
Maryland:	
Antietam, Potomac River	5,700
Brandywine, Tanglewood Pond	100
Michigan:	
Farwell, Loon Lake	500
Klinger Lake, Klinger Lake	500
Tamarack Lake	400
Thompson Lake	400
Ramona, Diamond Lake	500
Royal Oak, Woodcrest Lake	150
Twin Lakes, Twin Lake	500
Wetmore, Bass Lake	300
Reddies Lake	300

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

SUNFISH (BREAM)—Continued.

Disposition.	Fingerlings, yearlings, and adults.
Michigan—Continued.	
Wetmore, Round Lake	300
Six Mile Lake	300
Minnesota:	
Caledonia, Gengle Lake	200
Schicks Lake	200
Homer, Blacksmith Slough	5,034
Mississippi River	5,000
Pettibone Park Lagoon	180
Rochester, Zumbro Mill Pond	330
Mississippi:	
Baldwyn, Davis's pond	150
Basic, Martin Spring Pond	150
Bay Springs, Bay Pond	200
Stringer's pond	200
Brookhaven, Bear Pen Lake	200
Hartman's lake	100
King's pond	400
Meyer's lake	400
Todd's lake	400
Tyler's lake	100
Byram, Willow Bend Pond	150
Canton, Baggott Pond	100
Carrollton, Woodley Pond	400
Charleston, Willow Pond	200
Columbus, Puckett's pond	300
Corinth, Hinton's pond	600
Crawford, Scales's pond	150
Crystal Springs, Chautauqua Lake	400
Elliott, Miers's pond	100
Enterprise, Double Branches Pond	100
Foster, Foster's pond	100
Gladys, Burns's pond	200
Jackson, Blue Lake	400
Horseshoe Lake	400
McKee's pond	100
Tan Creek Lake	200
Whites Lake	300
Kosciusko, Crosby's pond	200
Lauderdale, East Lake	100
Laurel, Howse's pond	200
Walters's lake	400
Walters's pond	400
Louin, Kennedy's pond	100
Price's pond	100
Louisville, Creosote Lake	700
McAdams, Steed's pond	600
McCool, Mountain Lake	200
McDonald, Spring Pond	600
Madison, Madison Mill Pond	400
Magnolia, Risher's pond	100
Meridian, Brock's pond	200
South Lake	500
Wanita Lake	500
Monticello, Neal's pond	400
Natchez, Auburn Pond	200
Ben Lomond Pond	100
New Albany, Neeley's pond	400
Shelton's pond	200
Young's pond	200
Newton, Summer's pond	100
Osborn, Gladney's pond	200
Love's pond	200
Pontotoc, Ridgeway Lake	300
Saltillo, Pane's pond	200
Sandersville, Sycamore Farm Ponds	200
Shuqualak, Anderson's pond	200
Henderson's pond	100
Star, Wilson's pond	100
Starkville, Daniel's pond	400
Gamble's pond	400
Parkes's pond	100
Wynn's pond No. 1	100
Wynn's pond No. 2	100
Stonington, Stonington Pond	400
Sumner, McCullough's pond	400
Mississippi—Continued.	
Thornton, Bee Lake	1,000
Toomsuba, Shannon's pond	100
Tupelo, Kings Creek	6,000
Town Creek	5,000
Union, Hitt's pond	100
Vance's pond	200
Vaiden, Heggie's pond	400
Waynesboro, Cochran's pond	100
West Point, Crump's pond	500
East Pond	150
Gable's pond	200
Ivy Pond	400
Sand Hill Pond	300
Tipton's pond	300
Water Oak Pond	200
Winona, Chadwick's pond	200
Missouri:	
Carthage, Hyde's pond	200
Grandview, Blue Ridge Pond	400
Willow Lake	200
Willow Pond	300
Kansas City, Dickey's pond	150
Lebanon, Boston's pond	100
Nevada, Riverside Lake	1,000
Palmyra, Bay de Charles	400
Parkville, Emily Heights Pond	500
Platte City, Wilson's lake	400
Rolla, Big Dry Fork	300
Little Dry Fork	300
Little Piney River	300
North Spring Creek	300
Swope Park, Lake of the Woods	200
Penn Valley Lake	200
Swope Park Lagoon	200
Versailles, Big Haw Creek	1,000
Kays Lake	500
Wells Lake	500
Montana:	
Mildred, Norris's pond	70
New Hampshire:	
Concord, Contoocook River	300
New Jersey:	
Hackettstown, State fish commission	500
Metuchen, Novitiate Lake	350
New Milford, Willow Pond	200
Westfield, High Orchard Pond	150
New Mexico:	
Cerrillos, Petrified Forest Pond	250
Willard, Beall's pond	100
New York:	
Elmira, Old City Pond	150
Tallman, De Groat's pond	100
North Carolina:	
Cary, Ivey's pond	50
Underwood's pond	50
Coats, Spring Branch Pond	75
Conway, Britt's pond	230
Enfield, Rocky Swamp Lake	500
Franklinton, Whiteside Pond	200
Willowdale Pond	200
Germantown, Spring Branch	50
Henderson, Faulkner Pond	70
Foxe's pond	35
Hendersonville, Little Oklawaha Pond	200
Kinston, Gray's pond	400
Jericho Pond	100
Lumberton, McMillans Mill Pond	500
McFarland, Moore's pond	300
Manson, Nutbush Pond	35
Marshall, Redman's pond	50
Mebane, Buck Creek Pond	50
Mill Creek Pond	50
Staggs Creek Pond	50
Tanglewood Lake	150
Morven, Clear Branch Pond	100

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

SUNFISH (BREAM)—Continued.

Disposition.	Fingerlings, yearlings, and adults.
North Carolina—Continued.	
Mount Olive, Taylor's lake	150
Newport, Carteret Lodge Pond	50
Raleigh, Harris's pond	100
Roseboro, Little Coharie Creek	400
Selma, Ennis's pond	200
University, Mill No. 7 Pond	50
Whitakers, White Oak Pond	300
North Dakota:	
Bottineau, Lake Metagoshe	300
Ohio:	
Akron, East Reservoir	860
Long Lake	860
Miller Lake	860
Mud Lake	1,060
Nesmith Lake	860
New Reservoir	860
Springfield Lake	860
Turkeyfoot Lake	860
Vaughn Lake	860
West Reservoir	860
Bruno, Buckeye Lake	425
Carrollton, Carrollton Creek, Indian Fork	200
Garrettsville, Silver Creek Pond	150
Lakeside Park, Buckeye Lake	400
Lockville, Sycamore Creek	150
New Lexington, St. Aloysius Pond	150
Northside, Muth's lake	200
Oakhurst Pond	100
Portsmouth, Pond Creek	150
Ravenna, Shady Nook Pond	100
Wayland, Crystal Pond	100
Willshire, Lakehurst Pond	850
Oklahoma:	
Calvin, Miller's pond	100
Elk City, Lake Coleman	100
Fargo, Lilac Pond	200
Guymon, Mitchell's pond	100
Hickory, Red Pond	200
Kenton, Plum Spring Pond	100
Kingfisher, Foster's pond	200
Kiowa, Wilson's pond	100
Okarche, Meade's pond	200
Okemah, Sherrill's pond	100
Ringwood, Hays' lake	100
Texhoma, Cottonwood Pond	100
Union, Boever's pond	100
Waurika, Pelican Lake	300
Pennsylvania:	
Bethlehem, Monocacy Pond	200
Brandamore, Brandywine Creek	300
Dowlins, Lockwood's pond	150
Eagles Mere, Eagles Mere Lake	100
Ephrata, Cocalico Creek	300
Conestoga Creek	800
Frackville, Kaufman Lake	125
Mud Run Dam	125
Kittaning, Cherry Pond	100
Lebanon, Lake Conewago	150
Mount Gretna Lake	150
Water House Lake	350
Mance, Walker Lake	200
Minersville, Pine Hill Pond	300
Oil City, Allegheny River	600
Philadelphia, Fairmont Park Aquarium	220
Phoenixville, Pickering Creek	150
Pine Grove, Little Swatara Creek	150
Rauschs, Kunkle's pond	200
Reading, Maiden Creek	225
Manatawny Pond	200
Neversink Pond	100
Tulpehocken Creek	200
Rosemont, Rosemont Lake	100
Pennsylvania—Continued.	
Spring City, French Creek	400
Virginville, Ontelaunee Creek	100
Williamsport, Lycoming Creek	600
South Carolina:	
Aiken, Round Top Pond	100
Beldoc, Doe Pond	75
Belton, Neals Creek, headwaters	100
Bethune, Foard Lake	75
Watts's mill pond	150
Blackville, Spring Creek	200
Campobello, Allens Creek	100
South Pocalet River	100
Cheraw, Grants Mill Pond	200
Maynard's mill pond	200
Watsons Creek	200
Chesterfield, Spring Pond	200
Clinton, Brush Lake	50
Columbia, Idle Hour Pond	200
Messers Mill Pond	75
Spring Pond	75
Ebenezer, Byrd's pond	300
Edmund, Congaree Creek	400
Craft's pond	200
Scouter Creek	200
Shumpert's pond	400
Florence, Black Creek	300
Fort Motte, Grazier Branch	300
Greenville, Mountain View Pond	200
Piney Mountain Lake	318
Hartsville, Lawton's pond	300
Irmo, Folk's pond	200
Johnston, Vileto Pond	75
Kershaw, Dunby Branch	300
Laurens, Boyd's pond	200
Laurens Cotton Mill Pond	200
Reedy River	300
Roper's pond	200
Watts Mill Pond	100
McBee, Cedar Creek	150
Swift Creek	150
Piedmont, Saluda River	200
Ridge Spring, Watson's pond	200
Ruby, Oliver's pond	200
St. Mathews, Wannamaker's pond	200
Sanford, White Oak Mill Pond	100
Scranton, Lynch's mill pond	800
Sharon, Thomson's pond	300
Society Hill, Steer Pen Springs Pond	100
Springfield, Dean Pond	75
Summerton, Pine Grove Pond	150
Timmonsville, Hill's pond	150
Trenton, Padget's pond	200
Westminster, Coneross Creek	200
Richland Creek	200
Westville, Rush's pond	200
South Dakota:	
Aberdeen, Prairie Park Pond	300
Blunt, Pleasant Valley Pond	350
Kennebec, Manger's pond	500
Phillip, Jansen's pond	200
Reliance, Willow Lake	500
Watertown, Lake Kampesca	1,500
Tennessee:	
Butler, Holly Spring Pond	100
Cleveland, Rainbow Lake	600
Cowan, Willow Pond	200
Decherd, Cash's pond	100
Dyer, Croom's pond	100
Elk Valley, Lynch's pond	100
Ethridge, Alexander's pond	300
Maryville, Pistol Creek, tributary	300
Newport, Indian Creek, branch of	300
Roan Mountain, Hampton Creek	175
Heaton Creek	175

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

SUNFISH (BREAM)—Continued.

Disposition.	Fingerlings, yearlings, and adults.
Tennessee—Continued.	
Sparta, Falling Water Creek	500
Springfield, Oak Lawn Pond	200
Stanton, Wright's pond	100
Trenton, Grider's pond	100
Yarbrough's pond	100
Texas:	
Athens, Black Lake	100
Broom's lake	100
Clear Lake	100
Garnett's pond	200
Stone's pond	50
Blooming Grove, Walker & Green's pond	100
Caldwell, Heslen's pond	75
Jackson's pond	75
Clint, Turner's lake	100
Cookville, Ford's pond	50
Crockett, El Caney Lake	100
Crowell, Railway Pond	300
Crystal City, Wilson Lake	100
Denison, Sand Creek Lake	100
Waterloo Reservoir	100
Elgin, Hanson's pond	100
Encinal, Rodriguez's pond	100
Grapeland, Darsey's pond	100
Wooters Lake	100
Greenbrier, Beckham Pond	100
Greenbrier Creek	200
Greenbrier Lake	200
Mud Creek	200
Greenville, Fish Lake	100
Mt. Pleasant, Narramore's pond	50
Paige, Southend Pond	100
Palestine, Dietz's pond	100
Pearsall, Melms's pond	100
Texas—Continued.	
Pecos, Hawkins's pond	100
Luman's pond	100
Pleasanton, Farris's pond	100
Royse City, Burrow Pond	100
San Marcos, Cape Lake	180
Somerville, Lang's lake	50
Willis, Forest Lake	100
Virginia:	
Appomattox, Caldwell's pond	200
Buena Vista, Hall's pond	200
Culpeper, Mountain Run	3,000
Dillwyn, Pearson's pond	200
Glamorgan, Guests River Pond	100
Hash's pond	200
Indian Creek Pond	100
Pound River Pond	100
Gordonsville, Carver's pond	100
Keysville, Tuggle's pond	100
Rectortown, Buckner's pond	150
Richmond, Drurys Pond	1,500
Warren, Black Rock Pond	200
Washington:	
Almira, Zimmerman's pond	100
Republic, Mud Lake	300
West Virginia:	
Parkersburg, Goff's pond	200
Wisconsin:	
La Crosse, Long Lake	275
Mississippi River	295,450
Superior, Amnicon Lake	500
Lyman Lake	500
Wyoming:	
Sheridan, Ranch Pond	300
Total [a]	690,757

[a] Lost in transit, 3,975 fingerlings.

PICKEREL.

Disposition.	Fingerlings, yearlings, and adults.
Iowa: Mississippi River	3,075

PIKE.

Iowa:	
Bellevue, Mississippi River	1,300
North McGregor, Mississippi River	1,300
Total	2,600

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

PIKE PERCH.

Disposition.	Eggs.	Fry.
Arkansas:		
Crescent, Willow Lake		400,000
Pangburn, Little Red River		400,000
Illinois:		
Freeport, Schofield Lake		360,000
Havana, State fish commission	7,500,000	
Hinsdale, Salt Creek		300,000
McHenry, Fox River		300,000
Meredosia, Meredosia Bay		220,000
Wyanett, Illinois & Mississippi Canal		300,000
Indiana:		
Angola, Crooked Lake		500,000
Jimerson Lake		400,000
Lake Gage		400,000
Lake James		500,000
Loon Lake		400,000
Marsh Lake		400,000
Silver Lake		400,000
Snow Lake		400,000
Claypool, Coldwell Lake		500,000
Shultz Lake		800,000
Columbia City, State fish commission	7,500,000	
Elkhart, St. Joseph River		800,000
Frankfort, Fairview Pond		200,000
Hamilton, Fish Lake		600,000
Indianapolis, White River	2,500,000	
Laporte, Bement Lake		400,000
Pierceton, North Webster Lake		500,000
Plymouth, Lake of the Woods		500,000
Tefft, Kankakee River		800,000
Iowa:		
Chester, Upper Iowa River		500,000
Le Mars, Grimes Lake		200,000
Mason City, Lime Creek		300,000
Kentucky:		
Beattyville, Kentucky River, Lock No. 13		600,000
Frankfort, Kentucky River, Lock No. 4		800,000
Greenup, Little Sandy River		300,000
Tygart River		300,000
Heidelberg, Kentucky River, Lock No. 13		600,000
Irvine, Kentucky River, Lock No. 11		900,000
Lexington, Lake Ellerslie, No. 4		400,000
Nicholasville, Kentucky River, Lock No. 5		800,000
Kentucky River, Lock No. 7		800,000
Old Landing, Kentucky River, Lock No. 12		900,000
Richmond, Kentucky River, Lock No. 10		1,000,000
Somerset, Buck Creek		500,000
Fishing Creek		400,000
Valley View, Kentucky River, Lock No. 8		700,000
Kentucky River, Lock No. 9		700,000
Versailles, Kentucky River, Lock No. 5		600,000
Massachusetts:		
Great Barrington, Garfield Lake		400,000
Lake Buel		400,000
Lee, Shaw Pond		400,000
Palmer, State fish commission	20,225,000	
Michigan:		
Battle Creek, Lake Gognac		400,000
Bay City, Saginaw Bay		6,000.000
Belle Isle Park, Detroit River		10,000,000
Cassville, Saginaw Bay		3,000,000
Detroit, State fish commission	15,000,000	
Greenville, Woodbeck Lake		500,000
Holly, Bush Lake		720,000
Hankinson Lake		600,000
Rood Lake		480,000
School Lot Lake		600,000
Newaygo, Spring Creek		200,000
Niles, Lake Chapin		600,000
Ortonville, Big Stone Lake		500,000
Rose Center, Bennett Lake		480,000
North Buckhorn Lake		600,000
White Cloud, Hess Lake		300,000
Long Lake		300,000
Yorkville, Gull Lake		750,000
Minnesota:		
Forada, Maple Lake		400,000
La Crosse, Closing Dam No. 2		100,000
Minnesota Channel Run		100,000
Turgetts Lake, outlet		200,000

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

PIKE PERCH—Continued.

Disposition.	Eggs.	Fry.
Minnesota—Continued.		
Rapidan, Blue Earth River		500,000
Stanton, Lake Byllesby		500,000
Missouri:		
Mexico, Burlington Lake		360,000
Newburg, Cave Spring Creek		400,000
Merrimec River		400,000
Pendleton, Lake Farm Club Lake		360,000
Rolla, Big Piney Creek		400,000
Gasconade River		400,000
Little Piney Creek		300,000
St. Joseph, State fish commission	10,000,000	
Wappapello, St. Francis River		400,000
Nebraska:		
Gretna, State fish commission	2,000,000	
New Hampshire:		
Concord, Contoocook River		500,000
Fitzwilliam, Laurel Lake		300,000
Laconia, Salt Marsh Pond		200,000
New Jersey:		
Greenwood Lake, Greenwood Lake		500,000
Lake Hopatcong, Budd Lake		500,000
Lake Hopatcong		500,000
Newfoundland, Green Pond		500,000
Millville, Union Lake		500,000
New York:		
Au Sable Forks, Fern Lake		400,000
Military Lake		400,000
Silver Lake		400,000
Whistle Pond		400,000
Bath, Lake Salubria		500,000
Binghamton, Castle Creek		300,000
Lily Lake		300,000
Susquehanna River		300,000
Cambridge, Hedges Lake		300,000
Cape Vincent, St. Lawrence River		400,000
Hopewell Junction, Mill Pond		400,000
New York City, New York Aquarium	500,000	
Painted Post, Conhocton River		500,000
Pine Bush, Shawangunk Kill River		400,000
Port Henry, Lake Champlain		600,000
Port Jervis, Bauer Lake		400,000
Portlandville, Goodyear Lake		800,000
Redwood, Millsite Lake		500,000
Wayland, Loon Lake		1,000,000
Yulan, Washington Lake		400,000
North Dakota:		
Devils Lake, Devils Lake	100,000	
St. Johns, State fish commission	5,000,000	
Ohio:		
Bedford, Clarks Lake		300,000
Catawba Island, Lake Erie		10,000,000
Isle St. George, Lake Erie		10,000,000
Kelleys Island, Lake Erie		10,000,000
Marietta, Muskingum River, First Pond		300,000
Middle Bass Island, Lake Erie		5,000,000
Nevada, Broken Sword Creek		300,000
Oak Harbor, Portage River		1,000,000
Put-in-Bay, State fish commission	261,625,000	
Russells Point, Indian Lake		500,000
Zoar, Tuscarawas River		300,000
Pennsylvania:		
Allentown, Streams in Lehigh County		3,000,000
Cammal, Pine Creek		300,000
Cherry Tree, Cush Cushion Creek		300,000
Cisna Run, Sherman Creek		600,000
Cly, Susquehanna River		300,000
Dalmatia, Mahantango Creek		400,000
Susquehanna River		500,000
Denver, Cocalico Creek		300,000
Hosensack, Hancock's pond		400,000
Huntingdon, Juniata River, Raystown Branch		400,000
Stone Creek		300,000
Jersey Shore, Pine Creek		300,000
Lewistown Junction, Juniata River		500,000
Manheim, Big Chiques Creek		300,000
Mapleton, Jackstown Pond, lower		100,000
Juniata River		300,000
Oil City, Henrys Bend Run		200,000
Peach Bottom, Susquehanna River		300,000

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

PIKE PERCH—Continued.

Disposition.	Eggs.	Fry.
Pennsylvania—Continued.		
Reading, streams in Berks County		6,000,000
Safe Harbor, Susquehanna River		500,000
Spring City, Saylors Pond		200,000
Tionesta, Allegheny River		500,000
Wanamaker, Manor Creek		200,000
Washingtonboro, Susquehanna River		300,000
Williamsport, Susquehanna River, West Branch		500,000
York Haven, Conewago Creek		300,000
Susquehanna River		300,000
Waterville, Pine Creek		300,000
South Dakota:		
Faith, Red Scaffold Creek		284,000
Watertown, Lake Kampesca		800,000
Tennessee:		
Manchester, Duck River, Bark Camp Fork		300,000
Springfield, Red River, South Fork		400,000
Vermont:		
Brandon, Burr Pond		300,000
Hickum Pond		400,000
High Pond		400,000
Lake Bomoseen		800,000
Lake Hortonia		500,000
Enosburg Falls, Lake Carmi		400,000
Greensboro, Long Pond		400,000
Lakeside, Groton Pond		500,000
Lunenburg, Neals Lake		400,000
Middlebury, Otter River		500,000
Miles Pond, Miles Pond		500,000
Montpelier, Nelson Pond		400,000
Morrisville, Lake Lamoille		500,000
Newport, Pensioners Pond		400,000
Pittsford, Burr Pond		300,000
East Pittsford Lake		300,000
Shelburne, La Platte River		200,000
South Ryegate, Round Pond		500,000
Swanton, Charcoal Creek		9,000,000
Lake Champlain		9,600,000
Missisquoi River		26,000,000
Walden, Cole's pond		300,000
Virginia:		
Buckton, Shenandoah River		500,000
Danville, Dan River		400,000
Riverside Lake		400,000
Sandy River		600,000
Lovettsville, Dutchman Run		1,500,000
Wytheville, Stones Mill Pond		400,000
Wisconsin:		
Antigo, Pickerel Lake		300,000
Black River Falls, Black River		300,000
Morrison Creek		300,000
Devils Lake, Devils Lake		300,000
Independence, Bugal Lake		400,000
La Crosse, Black River		200,000
Black River, tributary		200,000
Closing Dam No. 1		100,000
Closing Dam No. 17		100,000
Coleman Slough		100,000
Crosby Slough		200,000
Dam No. 4		100,000
Dam No. 45		100,000
Joe Lynn Slough		100,000
Lower Halfway Creek		200,000
Mississippi River, East Channel		100,000
Sand Slough		200,000
Yellow Banks Slough		100,000
Merrillan, Trow Pond		300,000
Pewaukee, Pewaukee Lake		500,000
Phelps, Little Twin Lakes		400,000
Rice Lake, Desair Lake		300,000
Lake Montanas		300,000
Rice Lake		300,000
Wausau, Big Rib River		300,000
Total[a]	331,950,000	185,914,000

[a] Lost in transit 500,000 fry.

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

YELLOW PERCH.

Disposition.	Eggs.	Fry.	Finger-lings.
Connecticut:			
Bantam, Bantam Lake		600,000	
Bridgeport, Hillside Pond		200,000	
East Hampton, Lake Pocotopaug		400,000	
Greenwich, Thompson's pond		100,000	
Delaware:			
Millboro, Indian River		500,000	
Georgia:			
Atlanta, Capitol Aquarium			30
Illinois:			
Carbondale, Thompsons Lake			300
Sterling, Lake Sinimississippi			450
Indiana:			
Bremen, Lake of the Woods			400
Indianapolis, White River			400
Marion, Mississenewa River			35
Orland, Wall Lake			400
Iowa:			
Corning, Vernon's pond			200
Gravity, Johnston's pond			100
Le Mars, Dalton Pond			200
Randall, Little Wall Lake			100
Kentucky:			
Morganfield, Silver Pond			200
Twin Ridge Pond			200
Maryland:			
Accokeek Creek, Potomac River		3,800,841	
Antietam, Potomac River			1,350
Bengies, Seneca Creek		400,000	
Bohemia River, Chesapeake Bay		5,000,000	
Broad Creek, Potomac River		11,402,523	
Bull Cove, Potomac River		3,800,841	
Bush River, Bush River		2,000,000	
Dickerson, Lake Blenheim			70
Elk River, Chesapeake Bay		15,000,000	
Northeast River, Chesapeake Bay		5,200,000	
Pomonkey Creek, Potomac River		3,800,841	
Piscataway Creek, Potomac River		15,203,364	
Spesutie Narrows, Chesapeake Bay		5,000,000	
Swan Creek, Chesapeake Bay		15,000,000	
Potomac River		7,601,682	
Union Bridge, Spring Lake		200,000	
Woodmont, Potomac River		1,500,000	
Massachusetts:			
Boston, applicant	500,000		
Lee, Greenwater Pond		400,000	
Laurel Lake		400,000	
Lower Goose Lake		400,000	
Lenox Dale, Stockbridge Pond		400,000	
Orange, Long Pond			200
Palmer, State fish commission	8,000,000		
Minnesota:			
Lanesboro, Root River, North Branch			300
Root River, South Branch			300
Rochester, Rochester Mill Pond			200
Zumbro Mill Pond			200
Zumbro River			230
Missouri:			
Ash Grove, Spring Lake			200
Nevada, Katy Allen Reservoir			200
Pottorf Lake			200
State Hospital Lake			200
Pleasant Hill, Kellog Lakes			200
New Jersey:			
Belvidere, Mountain Lake		500,000	
Clementon, Clementon Lake		500,000	
Freehold, Topenomez Lake		500,000	
Grenloch, Grenloch Lake		500,000	
Hammonton, Hammonton Lake		500,000	
Lower Jamesburg, Jamesburg Lake		500,000	
Mays Landing, Estellville Lake		500,000	
Newark, Branch Brook Park Lake		500,000	
New Brunswick, Westons Lake		500,000	
Pleasantville, Bargaintown Lake		500,000	
Princeton, Carnegie Lake		1,000,000	
Rahway, Bloodgood Lake		500,000	
Sewell, Tylers Lake		500,000	
Swedesboro, Mitchels Lake		500,000	

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

YELLOW PERCH—Continued.

Disposition.	Eggs.	Fry.	Fingerlings.
New Mexico:			
Las Vegas, Asylum Reservoir			100
New York:			
Altmar, Henderson Lake		300,000	
Sheridan Pond		300,000	
Stevens Cold Brook Pond		300,000	
Highland Falls, Roe Lake		300,000	
New York City, New York Aquarium	1,000,000		
Schenectady, Collins Lake		500,000	
North Carolina:			
Henderson, Young's pond			135
Mayesworth, Duharts Creek			30
Wilmington, Greenfield Lake			135
North Dakota:			
Cayuga, Andrews Lake			300
Kasts Lake			300
Lake Margarette			300
Willow Lake			300
Oklahoma:			
Optima, Ansley's pond			25
Pennsylvania:			
Blairsville, Conemaugh River			100
Icedale, Brandamore Creek		1,000,000	
Kittanning, Cherry Pond			200
Reading, Beaver Creek		400,000	
Wellsboro, Marsh Creek			150
Westgrove, White Clay Creek		200,000	
South Carolina:			
Green Pond, Jack Hutum Pond			100
Lanford, Buck Head Creek			200
South Dakota:			
Crocker, Round Lake			600
Philip, Medicine Creek Pond			200
Vermont:			
Brandon, Lake Hortonia		500,000	
Cambridge, Half Moon Pond		400,000	
Medcalf Pond		400,000	
Fairlee, Mud Pond		400,000	
Hydeville, Lake Bomoseen		500,000	
Plainfield, Nelson Pond		400,000	
Swanton, Missisquoi River		1,400,000	
Thetford, Lake Morey		500,000	
West Danville, Joes Pond		400,000	
Virginia:			
Dogue Creek, Potomac River		22,805,046	
Little Hunting Creek, Potomac River		22,805,046	
Lovettsville, Dutchman Run		1,300,000	
Mosely, Swift Creek			70
Pohick Creek, Potomac River		19,004,205	
Washington:			
Coulee City, Haynes Lake			40
Wisconsin:			
La Crosse, Mississippi River			2,325
Sheboygan Falls, Sheboygan River			300
Total[a]	9,500,000	179,924,389	12,775

[a] Lost in transit 1,380 fingerlings.

STRIPED BASS.

Disposition.	Fry.
North Carolina: Weldon, Roanoke River	11,689,000

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

WHITE PERCH.

Disposition.	Eggs.	Fry.	Finger-lings.
Connecticut:			
Bristol, Compounce Lake		495,000	
Seymour, Carrington Pond		330,000	
Thompsonville, Lake Easy		660,000	
District of Columbia: Washington, Potomac River		18,000,000	
Maine:			
Brooks, Randall Lake		500,000	
Fryeburg, Lovewells Pond		400,000	
Norway, Kezar Lakes		400,000	
Lake Keenaydin		700,000	
Lake Pennesseemassee		600,000	
Virginia Lake		700,000	
Oldtown, Pickerel Pond		300,000	
Walker, Squa Pan Lake		700,000	
West Paris, Big Concord Pond		330,000	
Pleasant Pond		330,000	
Maryland:			
Antietam, Potomac River			2,000
Baltimore, Popular Pond		500,000	
Bladensburg, Bellevue Pond		400,000	
Bohemia River, Chesapeake Bay		10,000,000	
Chase, Dundee Creek		400,000	
Eastern Flats, Chesapeake Bay		27,350,000	
Furnace Creek, Chesapeake Bay		25,000,000	
Henderson Point, Chesapeake Bay		10,000,000	
Spesutie Narrows, Chesapeake Bay		15,000,000	
Swan Creek, Chesapeake Bay		36,000,000	
Swan Creek		5,000,000	
Town Point, Chesapeake Bay		15,000,000	
Elk River		5,000,000	
Western Flats, Chesapeake Bay		25,000,000	
Massachusetts:			
Boston, applicant	400,000		
Clinton, West Pond		300,000	
Congamond, Congamond Lake		495,000	
Falmouth, Mares Pond		825,000	
Forge Village, Forge Pond		500,000	
Franklin, Franklin Pond		200,000	
Graniteville, Keyes Pond		250,000	
Lancaster, Spectacle Pond		500,000	
Lowell, Crystal Lake		250,000	
Lynn, Rhedon Pond		250,000	
Upper Pond		125,000	
North Littleton, Knopps Pond		700,000	
Orange, Long Pond		330,000	
South Chelmsford, Baptist Pond		250,000	
West Chelmsford, Flushing Pond		250,000	
Long Sought Pond		250,000	
Nabnassett Pond		250,000	
New Hampshire:			
Concord, Newfound Lake		500,000	
Penacook Lake		500,000	
Durham, Oyster River		125,000	
Greenfield, Otter Lake		500,000	
Sunset Lake		500,000	
Hillsborough, Loon Pond		500,000	
Laconia, State fish commission	1,000,000		
Meredith, Lake Winnepesaukee		800,000	
North Weare, Weare Reservoir		600,000	
Sanbornville, Lovell Lake		500,000	
New Jersey: Boonton, Green Pond		1,000,000	
New York:			
Altamont, Norman Kill Creek		495,000	
Brooklyn, York Lake		250,000	
Pine Plains, Stissing Lake		495,000	
White Plains, Rye Lake		495,000	
Pennsylvania:			
West Grove, Forsythes Lake		200,000	
White Clay Creek		200,000	
Rhode Island: Woonsocket, Sheeneconett Pond		330,000	
Vermont:			
Bennington, Barber Pond		330,000	
Benton Pond		330,000	
Lake Hancock		330,000	
Walden, Coles Pond		300,000	
Virginia:			
Lovettsville, Dutchman Run		3,750,000	
Reedville, Back Creek		750,000	
Total	1,400,000	218,600,000	2,000

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

WHITE BASS.

Disposition.	Fingerlings, yearlings, and adults.
Iowa: Bellevue, Mississippi River	4,000
Kentucky:	
Louisville, Wooldridges Pond	100
Winchester, New Lake	350
Total	4,450

COD.

Disposition.	Fry.
Maine:	
Boothbay Harbor, Boothbay Harbor	4,083,000
Linekins Bay	1,776,000
Massachusetts:	
Bell Buoy, Vineyard Sound	2,566,000
Beverly, Massachusetts Bay	8,350,000
Buzzards Bay, Buzzards Bay	3,425,000
Cape Poge,Nantucket Sound	10,400,000
Edgartown Harbor, Nantucket Sound	5,933,000
Eel Pond, Eel Pond	12,840,000
Falmouth, Great Harbor	2,148,000
Nantucket Sound	7,041,000
Vineyard Sound	4,695,000
Gloucester, Atlantic Ocean	24,610,000
Gosnold, Nantucket Sound	1,678,000
Robinson Hole	3,434,000
Vineyard Sound	50,830,000
Great Harbor, Vineyard Sound	8,553,000
Massachusetts—Continued.	
Jobs Neck, Vineyard Sound	4,984,000
Manchester, Massachusetts Bay	4,220,000
Marblehead, Massachusetts Bay	5,690,000
Nobska Light, Nantucket Sound	3,621,000
Vineyard Sound	15,564,000
Robinsons Hole, Vineyard Sound	4,386,000
Rockport, Atlantic Ocean	10,590,000
Ipswich Bay	11,320,000
Tarpaulin Cove, Vineyard Sound	17,762,000
Tisbury, Vineyard Sound	936,000
Uncatena Point, Buzzards Bay	6,802,000
Woods Hole, Great Harbor	1,330,000
Vineyard Sound	8,076,000
Woods Hole Harbor	4,153,000
Vineyard Haven, Nantucket Sound	1,146,000
Total	252,951,000

POLLOCK.

Maine:	
Boothbay Harbor, Boothbay Harbor	19,223,422
Massachusetts:	
Beverly, Massachusetts Bay	101,960,000
Gloucester, Atlantic Ocean	146,025,000
Ipswich Bay	38,700,000
Massachusetts Bay	28,820,000
Massachusetts—Continued.	
Manchester, Massachusetts Bay	76,585,000
Marblehead, Massachusetts Bay	43,730,000
Rockport, Atlantic Ocean	50,285,000
Ipswich Bay	52,080,000
Salem, Massachusetts Bay	4,000,000
Total	561,408,422

MACKEREL.

Disposition.	Fry.
Massachusetts:	
Great Harbor, Vineyard Sound	898,000
Quissett, Buzzards Bay	1,612,000
Total	2,510,000

HADDOCK.

Maine:	
Boothbay Harbor, Boothbay Harbor	894,000
Massachusetts:	
Beverly, Massachusetts Bay	9,210,000
Gloucester, Atlantic Ocean	44,770,000
Ipswich Bay	3,090,000
Marblehead, Massachusetts Bay	9,670,000
Rockport, Atlantic Ocean	25,230,000
Ipswich Bay	15,720,000
Total	108,584,000

Details of distribution of fish and eggs during the fiscal year 1914—Continued.

FLATFISH.

Disposition.	Fry.
Maine:	
Boothbay, Back River	1,949,000
Sheepscot River	5,924,000
Boothbay Harbor, Boothbay Harbor	380,603,000
Hodgdons Cove	7,328,000
Linekin Bay	77,764,000
Mill Cove	32,583,000
Pig Cove	7,406,000
Townsend Gut	3,703,000
East Boothbay, Linekin Bay	14,810,000
Southport, Ebencook Harbor	24,011,000
Massachusetts:	
Beverly, Massachusetts Bay	9,000,000
Falmouth, Buzzards Bay	28,997,000
Deacons Pond Harbor	21,339,000
Little Harbor	14,031,000
Nantucket Sound	77,880,000
Vineyard Sound	44,947,000
Waquoit Bay	28,887,000
Massachusetts—Continued.	
Gloucester, Annisquam River	19,550,000
Gloucester Harbor	187,330,000
Gosnold, Hadley Harbor	15,567,000
Nantucket Sound	13,567,000
Vineyard Sound	52,859,000
Manchester, Manchester Harbor	9,100,000
Massachusetts Bay	8,930,000
Nobska, Vineyard Sound	6,434,000
Provincetown Provincetown Harbor	15,000,000
Rockport, Rockport Harbor	8,100,000
Tisbury, Vineyard Sound	2,222,000
Woods Hole, Woods Hole Harbor	5,000,000
Rhode Island:	
Wickford, Wickford Harbor	46,500,000
Total	1,171,321,000

LOBSTER.

Maine:	
Ashdale, Burntcoat Harbor	1,000,000
Bass Harbor, Bluehill Bay	2,000,000
Biddeford, Biddeford Pool	7,000,000
Wood Isle Harbor	1,500,000
Boothbay Harbor, Boothbay Harbor	4,000,000
Hodgdons Cove	1,000,000
Indiantown Cove	1,000,000
Linekin Bay	2,000,000
Mill Pond	3,000,000
Bristol, Christmas Cove	2,000,000
Johns Bay	1,000,000
Pemaquid Harbor	2,000,000
Robinsons Cove	2,000,000
Round Pond Harbor	500,000
Cape Porpoise, Cape Porpoise Harbor	5,000,000
Castine, East Penobscot Bay	500,000
Cundys Harbor, New Meadows River	3,000,000
Cushing, Point Gut	1,000,000
Duck Cove, Bluehill Bay	250,000
Eagle, Penobscot Bay	650,000
Eastport, Broad Cove	5,000,000
East Stuben, Dyers Bay	4,000,000
Edgecomb, The Eddy	500,000
Ellsworth, Union River Bay	2,000,000
Friendship, Friendship Harbor	2,000,000
Georgetown, Fire Isle Harbor	1,000,000
Harmans Harbor	500,000
Little Sheepscot River	2,250,000
Isle au Haut, Isle au Haut Bay	250,000
Jonesport, Jonesport Harbor	1,500,000
Kennebunk Port, The Creek	1,000,000
Wills Bay	2,000,000
Kittery, Pepperill Cove	4,000,000
Lawry, Delanos Cove	1,000,000
Little Deer Isle, East Penobscot Bay	250,000
Hardy Cove	200,000
Millbridge, Pigeon Hill Bay	3,000,000
New Harbor, Muscongus Sound	3,000,000
North Haven, Fox Isle Thoroughfare	500,000
Maine—Continued.	
North Haven, Pulpit Harbor	150,000
Ogunquet, Wills Bay	1,000,000
Philipsburg, Burntcoat Harbor	4,000,000
Portland, Portland Harbor	3,000,000
Prospect Harbor, Prospect Harbor	4,000,000
Robinston, Passamaquoddy Bay	500,000
Rockland, Rockland Harbor	8,000,000
Rockport, Penobscot Bay	250,000
Rogue Bluff, Pond Cove	3,000,000
Round Pond, Muscongus Sound	2,000,000
St. George, Pleasant Point Gut	7,000,000
South Hancock, Skillings River	7,000,000
Southport, Cape Newagon Harbor	4,000,000
Ebencook Harbor	3,500,000
Pig Cove	1,500,000
Southwest Harbor, Somes Sound	3,000,000
Sprucehead, Muscle Ridge Channel	10,000,000
Stonington, East Penobscot Bay	2,250,000
Sunset, East Penobscot Bay	500,000
Swans Isle, Bluehill Bay	1,500,000
Vinal Haven, Long Cove	3,000,000
Sands Cove	15,000,000
Wills, Wills Bay	1,000,000
Wiscassett, Sheepscot River	500,000
Yarmouth, Cousins Isle Harbor	8,000,000
York Harbor, York River	2,000,000
Massachusetts:	
Beverly, Massachusetts Bay	1,200,000
Gloucester, Annisquam River	300,000
Atlantic Ocean	2,000,000
Gloucester Harbor	300,000
Manchester, Massachusetts Bay	1,040,000
Marblehead, Massachusetts Bay	400,000
Rockport, Atlantic Ocean	850,000
Ipswich Bay	400,000
New Hampshire:	
New Castle, Little Harbor	2,000,000
Portsmouth, Portsmouth Harbor	1,500,000
Washington:	
Deer Harbor, Puget Sound	[a] 2,676
Friday Harbor, Puget Sound	[a] 891
Total fry [b]	179,990,000

[a] Adults.

[b] Lost in transit, 440 adults.

FRESH-WATER MUSSEL PROPAGATION.

The propagation of fresh-water pearl mussels, recently undertaken at various places in the Mississippi Valley in connection with the Fairport, Iowa, Biological Station, has reached considerable proportions, and in the fiscal year 1914 resulted in the planting of 227,536,814 glochidia or larval mussels, about 50 per cent more than were planted in the preceding year. Incidentally to these operations 167,819 fishes were used, of which 66,645 were rescued from overflowed lands and returned to the parent streams.

The following table gives the number of each species of mussels planted, and the locality in which the fish infected with them were liberated:

MUSSEL PROPAGATION, FISCAL YEAR ENDING JUNE 30, 1914.

Points of deposit and species of glochidia used for inoculation.

	Mississippi River, Fairport, Iowa.	Lake Pepin, Lake City, Minn.	Mississippi River, La Crosse, Wis., steamer Curlew.	Wabash River, Vincennes, Ind.	Maumee River, Fort Wayne, Ind.	Black River, Black Rock, Ark.	White River, Newport and Clarendon, Ark.	Total.
Pocketbook (*Lampsilis ventricosa*)	1,320,000	5,340,500	110,000					6,770,500
Mucket (*Lampsilis ligamentina*)	68,766,000	943,000	5,286,000	16,748,900		8,448,000	126,000	100,317,900
Fat Mucket (*Lampsilis luteola*)	6,690,000	94,652,700						101,342,700
Pocketbook (*Lampsilis capax*)	653,000							653,000
Black sand-shell (*Lampsilis recta*)	5,347,000	200,000	70,000	199,000			79,000	5,895,000
Yellow sand-shell (*Lampsilis anodontoides*)	8,174,000		1,850,000	1,187,600	234,614	392,000	4,521,000	16,359,214
Slough sand-shell (*Lampsilis fallaciosa*)	364,000			1,102,000				1,466,000
Butterfly (*Plagiola securis*)	666,000			20,500				686,500
Higgins-eye (*Lampsilis higginsii*)	46,000							46,000
Total	92,026,000	101,136,200	7,316,000	19,258,000	234,614	8,840,000	4,726,000	233,536,814

CONDITION AND EXTENT OF THE NATURAL OYSTER BEDS AND BARREN BOTTOMS OF LAVACA BAY, TEXAS

By H. F. Moore

Assistant in Charge of Scientific Inquiry
U. S. Bureau of Fisheries

AND

Ernest Danglade

Scientific Assistant

Appendix II to the Report of the U. S. Commissioner
of Fisheries for 1914

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CONDITION AND EXTENT OF THE NATURAL OYSTER BEDS AND BARREN BOTTOMS OF LAVACA BAY, TEXAS.

By H. F. Moore, *Assistant in Charge of Scientific Inquiry, Bureau of Fisheries,*

AND

Ernest Danglade, *Scientific Assistant.*

INTRODUCTION.

This survey was made at the request of Col. W. G. Sterett, game, fish, and oyster commissioner of Texas, preferred through Hon. A. S. Burleson, at that time Representative in Congress from Texas, who secured an act of Congress authorizing the work.

The investigation began on February 1, 1913, and was concluded May 12. The steamer *Fish Hawk* served as the base of operations until the examination of the lower two-thirds of the bay had been completed, after which, from April 1 until the end of the work, the field party, consisting of the scientific staff and a detail from the vessel, made their headquarters on a shallow-draft schooner which could enter the shoal waters not practicable for the steamer.

The survey was under the immediate direction of Mr. T. E. B. Pope, scientific assistant, whose subsequent resignation from the service prevented his preparation of the report. Mr. Danglade was second in charge and the biological investigations were made by him. Chief Boatswain William Martin was in command of the vessel until his detachment, after which Boatswain J. J. O'Brien assumed command.

The work was much hampered by bad weather, and after practically all of the signals had been erected they were blown down by a gale. The triangulation was carried into the bay from two old stations ("Sand" and "La Salle") of the Coast and Geodetic Survey which were recovered. The signals were cut in as carefully as possible with the sextant, the accuracy of the work being checked by erecting certain of the signals in two ranges diverging from "Sand." While this method does not give the precision exacted by the Coast Survey, it is sufficiently exact for the purposes of the present investigation.

No previous oyster survey has been made in Lavaca Bay, but in 1905 an investigation similar to this was conducted in Matagorda Bay, above Half Moon Reef, a report being published in the following year.

METHODS OF THE SURVEY.

The methods employed were those pursued in former surveys of like character, and are explained in detail in a description of the beds of the James River,[a] from which some of the following is repeated:

A "boat sheet" was prepared, on which were accurately platted the positions, as determined by triangulation, of lighthouses, buildings, tripods, etc., used as signals. These data were furnished by the United States Coast and Geodetic Survey.

The oyster beds were discovered by soundings with a lead line, but principally by means of a length of chain dragged over the bottom at the end of a copper wire running from the sounding boat. The wire was wound on a reel and its unwound length was adjusted to the depth of water and the speed of the launch, so that the chain was always on the bottom. Whenever the chain touched a shell or an oyster the shock or vibration was transmitted up the wire to the hand of a man whose sole duty it was to give heed to such signals and report them to the recorder.

The launches from which the soundings were made were run at a speed of between 3 and 4 miles per hour. At intervals of three minutes—in some cases two minutes—the position of the boat was determined by two simultaneous sextant observations of the angles between a set of three signals, the middle one of which was common to the two angles, the position being immediately platted on the boat sheet. At regular intervals of 15 seconds, as measured by a clock under the observation of the recorder, the leadsman made a sounding and reported to the recorder the depth of the water and the character of the bottom, immediately after which the man at the wire reported the character of the chain indications since the last sounding—that is, whether they showed barren bottom or dense, scattering, or very scattering growths of oysters.

With the boat running at 3 miles per hour the soundings were between 60 and 70 feet apart, and, as the speed of the boat was uniform, the location of each was determinable within a yard or two by dividing the platted distance between the positions determined by the sextant by the number of soundings. The chain, of course, gave a continuous indication of the character of the bottom, but the record was made at the regular 15-second intervals observed in sounding.

The chain, while indicating the absence or the relative abundance of objects on the bottom, gives no information as to whether they are shells or oysters, nor, if the latter, their size and condition. To obtain these data it was necessary to supplement the observations already described by others more definite in respect to the desired particulars. Whenever, in the opinion of the officer in charge of the sounding boat, such information was required, a numbered buoy was dropped, the time and number being entered in the sounding book. Another launch, following the sounding boat, anchored alongside the buoy, and a quantity of the oysters and shells were tonged up, separated by sizes, and counted.

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[a] Moore, H. F.: Condition and extent of the oyster beds of James River, Va. Bureau of Fisheries Document no. 729.

This boat at each station made a known number of "grabs" with the oyster tongs, exercising care to clean the bottom of oysters as thoroughly as possible at each grab. In a given depth of water and using the same boat and tongs, an oysterman will cover practically the same area of the bottom at each grab, but, other factors remaining the same, the area of the grab will decrease with an increase in the depth.

Careful measurements were made and tabulated showing the area per grab covered by the tonger employed on the work at each foot of depth of water and for each pair of tongs and boat used. With these data, and knowing the number of "grabs," the number of oysters of each size per square yard of bottom was readily obtainable by simple calculation. The following example will illustrate the data obtained and the form of the record:

DEPARTMENT OF COMMERCE AND LABOR.

BUREAU OF FISHERIES.

Field record of examinations of oyster beds.

General locality, *Mississippi Sound.*
Local name of oyster ground, *Scranton Reef.*
Date, *February 1, 1911.*
Time, 2.00 p. m.
Angle, *II 101.*
Buoy No. *6.*
Depth, *4.3.*
Bottom, *Soft, over 7½″.*
Condition of water, *Thick.*
Density, *1.016.*
Temperature, *19.*
Current,
Stage of tide, *Flood.*
No. grabs made, *8.*
Tongs, *10 feet.*
Total area covered, *2.36* square yards.
No. oysters taken { —1 in., *20.* 1 in.–3 in., *101.*
3 in.–4 in., *11.* 4 in., *0.*
Quantity shells, *0.* *8 dead.*
Result { Spat per square yard, *8.3.*
Culls per square yard, *42.2.*
Counts per square yard, *4.6.*

This furnishes an exact statement of the condition of the bed at the spot, which can be platted on the chart with error in position of not more than a few yards. From the data obtained a close estimate may be formed of the number of bushels of oysters and shells per acre in the vicinity of the examination, and, by multiplying the observations, for the bed as a whole. In the course of the survey 472 observations were made at various places, principally on the natural rocks, but some on the barren bottoms also.

In estimating the productiveness of the bottoms it appeared desirable to use the method employed in Delaware Bay [a] rather than that followed in the James River survey.

Where tongs are used exclusively a bed with a given quantity of oysters lying in shoal water is more valuable commercially than one with the same quantity of oysters in deeper water, owing to the fact that the labor of the tonger is more efficient on the former. As has been pointed out, the area covered by a "grab" decreases with the depth, other factors being the same; and, moreover, the deeper the water the greater is the labor involved in making the grab and the smaller is the number of grabs which can be made in a given time. Where, however, the depth is practically uniform and shoal, as in the region treated in this report, it is unnecessarily refined and laborious to make such allowance for depth, and it is nearly as accurate and satisfactory to rate the bottoms in accordance with an arbitrary standard.

In this report the classification of the relative productiveness of the various beds and parts of beds, as exhibited on the chart and discussed in the text, is as follows:

Dense growth	Bearing over 150 bushels per acre.
Scattering growth	Bearing between 75 and 150 bushels per acre.
Very scattering growth	Bearing between 25 and 75 bushels per acre.
Depleted bottom	Bearing less than 25 bushels per acre.

This classification refers solely to oysters of a size assumed to be large enough for the market, in this case to those 3 inches or more in length. As the classification takes no account of the smaller oysters, certain areas bearing a heavy growth of young may be described and shown on the chart as depleted, owing to the paucity of mature oysters. While the charts can not indicate this, the descriptions of the beds show it in all cases. The charts show in general terms the character of the beds in respect to the product available for market, so far as mere size of the oysters is concerned, at the time of the survey. If the oysters were of ordinarily good condition and shape, which unfortunately in most cases they were not, the areas indicated as bearing dense and scattering growth would yield a product sufficient to make tonging remunerative under the economic conditions existing. Where the market oysters are rated as very scattering, the growth is insufficient to support a fishery at the low price which the product would yield. The depleted bottom is that on which the product of market oysters, at the time of the survey, was very small, and is not necessarily formerly productive bottom now denuded, as might be supposed from a strict definition of the descriptive term employed. On the contrary, it may be formerly barren bottom now coming into production.

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[a] Condition and extent of the natural oyster beds of Delaware. By H. F. Moore, assistant, United States Bureau of Fisheries. Bureau of Fisheries Document no. 745, 1911.

The barren bottom, which is that totally devoid of oysters, and in most cases of shells, vastly exceeds the oyster bottom in extent. Its interest in connection with the survey lies in its relative availability for oyster culture; that is, whether or not its general character is such as to enable it to become productive if proper measures to that end be taken. The most important consideration is, usually, the character and degree of stability of its constituent materials. If the bottom be too soft, the shells and oysters deposited thereon will soon become engulfed.

In previous surveys the method ordinarily used by oystermen has been employed, the consistency of the bottom being determined by probing with a pole. By noting the resistance which the bottom imposes to the penetration of the probe, the observer forms an opinion of its relative hardness and of its suitability in that respect for oyster culture. In many cases different observers will not agree as to the proper term by which to describe the bottom so tested, and it is therefore difficult to convey to another the meaning desired. To overcome this difficulty an instrument [a] has been devised which gives these data mechanically, by measuring the number of inches the bottom is penetrated by a plunger of a constant weight and size falling through a uniform distance. The instrument is used from an anchored boat, from 6 to 10 tests being made at each station. Any readings which are markedly higher or lower than the others are discarded on the assumption that the plunger has fallen into a crab hole or other depression, or that it has encountered a shell or similar accidental obstruction. The average of the remaining depths of penetration, as indicated on the scale of inches inscribed on the rod, is regarded as the measure of the consistency of the bottom.

The following designations used to indicate the different degrees of hardness, as shown by the instrument, are arbitrary, although based on the terms used by the oyster growers:

Hard	Penetration less than 4 inches.
Stiff	Penetration between 4 and 8 inches.
Soft	Penetration between 8 and 13 inches.
Very soft	Penetration between 13 and 18 inches.
Ooze	Penetration over 18 inches.

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[a] Illustrated and described in "Condition and extent of the natural oyster beds and barren bottoms of Mississippi Sound, Alabama." By H. F. Moore, Bureau of Fisheries Document no. 769.

These various types of bottom are shown on the chart by means of circles, the relative area of black included within them indicating the relative degree of hardness, as follows: Hard, a black circle; stiff, a black semicircle; soft, a black quadrant; very soft, two crossing diameters; ooze, one diameter.

The bottoms classed as hard and stiff, those in which the plunger will not penetrate more than 8 inches, are suitable for planting without preparation, provided they are not composed of shifting sand. As sand invariably gives a reading of less than 4 inches, and is therefore rated as "hard," it follows that all "stiff" bottom shown on the chart by a black semicircle can be accepted as safe for planting. Part of the hard bottom is composed of mud and part of sand. The former may be accepted without hesitation, but the latter should be examined with respect to its liability to shift. Soft bottom should be planted with care, and toward its upper or less consistent limits may require some preliminary hardening with shells or sand. Very soft bottom and ooze should not be considered, as oysters planted there will sink, and if not killed, as is probable, will be ill-shaped and inferior in every respect. The ratings on which the classification is based have been checked by observation on bottoms actually used for oyster culture in Chesapeake Bay.

The instrument employed has been thoroughly tested and is reliable for the purposes of oyster surveys, but there may be errors in cases where hard bottom is overlaid by several inches of soft mud and ooze. Such bottoms are always readily detected by probing with a pole.

LAVACA BAY.

Lavaca Bay is the northwest arm of Matagorda Bay and, exclusive of minor bays, covers an area of about 60 square miles. Its greatest width, including Kellers Bay, is about 7 miles, and it has a length, from Sand Point to the head of Garcitas Bay, of about 12½ miles. It is about 2 miles wide at its mouth, but the effective width for purposes of navigation is much reduced by bars and oyster reefs. The mouth is about 15 miles from Pass Cavallo, the entrance from the Gulf of Mexico, in which there is a variable depth of 9 to 10 feet on the bar. Most of the lower half of the bay, excluding the shore waters and the reefs, is from 7 to 9 feet deep, and a draft of about 7 feet can be carried at low water through the two short dredged channels and to within a short distance of Lavaca, the only town on the bay and the center of the oyster industry of the region. The upper half of the bay has an average depth of 4 to 5 feet. The streams tributary are Cavallo River, Garcitas River, Benado Creek, and Lavaca River, of which the latter is the largest. All of these flow into the upper part of the bay.

In the survey 16,153 soundings were made on lines aggregating 362 miles, the position of the boat being instrumentally fixed at about 800 places. The character of the oysters and the nature of the bottom were determined at 464 stations, of which 228 were on the reefs and 236 on barren bottom, in addition to continuous chain readings over a distance of 362 miles. The data available, therefore, are sufficient to give an unusually accurate idea of the conditions for both natural growth and oyster culture.

DESCRIPTION OF NATURAL BEDS.

SAND POINT REEF.

This reef is located on the northwest side of Sand Point and extends in a southwesterly direction to join the more productive Middle Ground Reef. There is no distinct line of demarcation between these two reefs, but there is a gradual change in the character of the bottom from sand to stiff mud. The average width of the reef is about one-fourth of a mile, the length is about seven-eighths of a mile, and the area is about 160 acres. Comparison of the charts of the present survey with the coast survey charts shows that this bed is gradually extending westward.

This reef bears singles and scattering bunches of good oysters, nearly all of which are marketable. It has been fished for at least the last 16 years and has never been entirely depleted, and at the time of the survey the average tonger could take about three barrels of oysters per day. On account of the protection afforded by Sand Point it is fished principally when weather conditions prevent the working of the more productive neighboring beds. The area, condition of oyster growth, and estimated content of this bed are shown in the following table:

Oyster Growth on Sand Point Reef.

Character of oyster growth.	Area.	Oysters per acre.		Estimated content of oysters.		
		Under 3 inches.	Over 3 inches.	Seed.	Market.	Total.
	Acres.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Dense	78	336	212	26,208	16,536	42,744
Very scattering	20	604	57	12,080	1,140	13,220
Depleted	62	136	6	8,432	372	8,804
Total	160	....	....	46,720	18,048	64,768

Details of Examination of Sand Point Reef.

Station.	Date of examination.	Depth of water.	Area covered.	Oysters caught per square yard.			Shells per square yard.	Estimated quantity oysters per acre.			Character of oyster growth.
				Spat.	Culls.	Counts.		Seed.	Market.	Total.	
	1913.	*Feet.*	*Sq. yds.*					*Bush.*	*Bush.*	*Bush.*	
48	Mar. 6	4.5	1.79	12.3	4.4	2.2	13	201	532	733	Dense.
101	Mar. 11	5.5	1.99	2.5	7.0	8.5	10	115	219	334	Do.
12	Mar. 6	5.5	1.99	43.7	42.2	4.1	29	1,031	99	1,130	Do.
100	Mar. 11	6.5	1.82	29.6	20.4	2.2	15	604	57	661	Very scattering.
47	Mar. 6	4.0	1.99	5.0	.0	.0	9	60	0	60	Depleted.
98	Mar. 11	5.0	2.12	10.4	7.1	0.5	12	212	13	225	Do.

The areas of more scanty growth lie along the eastern margin of the bed, the dense growth being found in the parts contiguous to the middle ground. The bottom over practically the entire bed is hard, owing to the preponderance of sand. The oysters for Sand Point Reef were, at the time of the survey, superior in shape and fatness to those from adjacent beds.

LUMPS NORTHEAST OF SAND POINT REEF.

There is a small lump of 5 acres about one-half mile to the northeast of Sand Point Reef. One station was made which disclosed 23.6 counts and 24 shells per square yard. Between this lump and Sand Point Reef the bottom is generally hard and affords more or less scattered and irregular clusters rather close to the shore line, but does not interfere with seining. There were formerly oysters of good quality here, although they were never dense, but they have been practically fished out.

A patch containing 67 acres of very scattering oysters is located near the main reef off Sand Point. The bottom is hard sand and the shells are more or less covered with yellow sponge.

The conditions on these unimportant patches are shown in the following table:

Oyster Growth on Lumps Northeast of Sand Point Reef.

Character of oyster growth.	Area.	Oysters per acre.		Estimated content of oysters.		
		Under 3 inches.	Over 3 inches.	Seed.	Market.	Total.
	Acres.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Dense	5	662	611	3,310	3,055	6,365
Very scattering	67	426	40	28,542	2,680	31,222
Total	72			31,852	5,735	37,587

Details of Examination of Lumps Northeast of Sand Point Reef.

Station.	Date of examination.	Depth of water.	Area covered.	Oysters caught per square yard.			Shells per square yard.	Estimated quantity oysters per acre.			Character of oyster growth.
				Spat.	Culls.	Counts.		Seed.	Market.	Total.	
	1913.	*Feet.*	*Sq. yds.*					*Bush.*	*Bush.*	*Bush.*	
94	Mar. 11	4.0	1.99	31.1	23.6	23.6	24	662	611	1,273	Dense.
96	...do.....	7.0	1.79	35.8	15.2	2.3	44	616	53	669	Very scattering.
97	...do.....	6.5	1.82	22.0	17.6	1.1	40	236	28	264	Do.

MIDDLE GROUND REEF.

This lies at the entrance of Lavaca Bay and extends from near the western shore line in a northerly direction for approximately 1⅞ miles, with an average width of about one-fourth mile. The upper half of the reef broadens toward the east and merges with Sand Point Reef, the arbitrary line of demarcation used in this report being the strip of deep water running toward the northeast. The greatest depth found in tonging on this reef was 8½ feet at the extreme western point and the least was 3½ feet near the beacons. There are, however, a number of depressions along the eastern border with a depth of 10 to 13½ feet, and the dredged channel marked by beacons no. 1 and no. 2 has a depth of 7 feet. The material dug from this channel was thrown to the westward of the beacons and becomes exposed during low tides. The extent and general condition of the bed are shown in the following table:

Oyster Growth on Middle Ground Reef.

Character of oyster growth.	Area.	Oysters per acre.		Estimated content of oysters.		
		Under 3 inches.	Over 3 inches.	Seed.	Market.	Total.
	Acres.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Dense	444	809	960	359,196	426,240	785,436
Scattering	28	761	137	21,308	3,836	25,144
Total	472	....	....	380,504	430,076	810,580

With the exception of a comparatively small area of scattering oysters near the northeast margin of the bed adjoining Sand Point Reef, the entire reef is covered with dense growth, which in some places amounts to nearly 4,900 bushels per acre, about equally divided between small and adults. It is not probable that this extraordinary deneness of growth obtains over a very wide area, but there are many places on which there are in excess of 2,500 bushels per acre. As is to be expected under such conditions, the oysters are clustered and rough, and in quality they are generally inferior to those on the less densely populated Sand Point Reef. The bed was tonged through the season and the average tonger could take about 4 barrels per day.

A few drills were found and some specimens of the yellow boring sponge.

The following table shows the details of the examination of the bed:

DETAILS OF EXAMINATION OF MIDDLE GROUND REEF.

Station.	Date of examination.	Depth of water.	Area covered.	Oysters caught per square yard.			Shells per square yard.	Estimated quantity oysters per acre.			Character of oyster growth.
				Spat.	Culls.	Counts.		Seed.	Market.	Total.	
	1913.	*Feet.*	*Sq. yds.*					*Bush.*	*Bush.*	*Bush.*	
1	Mar. 5	4.0	2.65	31.6	17.7	23.0	8	578	555	1,133	Dense.
2	...do.....	5.0	1.59	18.3	17.6	17.6	8	430	428	858	Do.
13	Mar. 6	5.5	1.99	53.8	37.2	55.3	20	1,092	1,336	2,428	Do.
14	...do.....	6.0	1.39	10.8	17.3	12.3	8	338	299	637	Do.
15	...do.....	5.5	1.99	25.6	15.6	35.7	11	496	862	1,358	Do.
16	...do.....	5.5	1.99	31.2	31.6	40.2	18	759	971	1,730	Do.
17	...do.....	5.5	1.99	33.2	32.2	69.9	20	789	1,687	2,476	Do.
18	...do.....	4.0	1.99	22.1	36.2	38.7	7	704	937	1,641	Do.
19	...do.....	5.0	1.59	34.6	40.8	52.8	19	909	1,279	2,188	Do.
20	...do.....	4.0	1.99	23.2	36.7	51.8	7	722	1,254	1,976	Do.
21	...do	5.0	1.59	28.9	48.5	47.2	8	934	1,141	2,075	Do.
22	...do.....	5.0	2.12	7.6	12.8	19.5	7	246	472	718	Do.
23	...do.....	6.0	1.86	21.5	22.1	27.1	5	526	657	1,183	Do.
24	...do.....	6.0	1.86	20.4	19.9	30.6	13	485	740	1,225	Do.
27	...do.....	6.5	1.82	14.3	15.4	19.8	8	359	478	837	Do.
50	Mar. 10	5.5	1.99	74.8	57.8	55.5	26	1,601	1,464	3,065	Do.
83	Mar. 11	6.5	4.17	6.0	7.5	5.8	6	163	150	313	Do.
84	...do.....	6.0	5.21	9.6	10.2	8.4	3	239	218	457	Do.
85	...do.....	6.0	3.91	21.0	12.3	20.5	7	402	530	932	Do.
86	...do.....	6.0	3.91	15.2	15.4	20.5	13	371	530	901	Do.
87	...do.....	5.0	4.41	16.1	19.8	38.6	17	434	998	1,432	Do.
90	...do.....	4.5	1.56	3.8	17.3	21.2	15	255	550	805	Do.
91	...do.....	4.5	4.73	19.2	18.9	28.9	12	578	749	1,327	Do.
102	Mar. 13	5.0	5.90	101.0	84.5	53.8	12	2,241	1,299	3,540	Do.
103	...do.....	6.5	3.13	86.0	105.0	107.0	22	2,312	2,582	4,894	Do.
104	...do.....	5.5	4.17	70.5	79.2	78.5	14	1,805	1,893	3,698	Do.
105	...do.....	6.0	3.90	108.5	74.7	72.5	9	1,780	1,746	3,526	Do.
106	...do.....	6.5	1.82	32.9	39.5	38.4	12	874	927	1,801	Do.
107	...do.....	6.0	1.39	51.7	56.1	60.4	26	1,302	1,457	2,759	Do.
108	...do.....	6.0	1.39	10.1	40.0	38.8	39	607	936	1,543	Do.
113	...do.....	5.5	1.99	12.1	17.1	16.1	14	353	389	742	Do.
114	...do.....	4.5	1.79	61.9	75.9	75.9	42	1,669	1,830	3,499	Do.
115	...do.....	8.5	2.00	14.0	14.5	15.0	30	344	362	706	Do.
11	Mar. 6	5.5	2.12	43.0	35.0	6.2	28	937	149	1,086	Scattering.
109	Mar. 13	7.0	1.79	35.2	39.6	5.6	44	906	135	1,041	Do.
112	...do.....	7.0	1.79	16.7	19.7	5.0	25	440	128	568	Do.

OLD TOWN BED.

This bed, which is rudely triangular in shape, with the broader end to the north, is located in the southern end of the bay near the entrance. It is separated from the preceding bed by a channel about 11 to 12 feet deep. It is about 1¼ miles long by one-third mile wide, and including the small lump to the south contains approximately 342 acres. The depth on the western side is from 4 to 4½ feet, while the greatest depth, that of 6½ to 7½ feet, is along the northern and eastern borders.

The oysters of this bed are frequently covered to some extent with yellow sponge, and they usually occur in large irregular clusters with sharp edges. But few drills were observed.

The quality of the oysters is not as good as that of the near-by Middle Ground Reef, and the bed was not being worked during the survey. The bed is composed entirely of dense growth, as shown in the following tables:

OYSTER GROWTH ON OLD TOWN BED.

Character of oyster growth.	Area.	Oysters per acre.		Estimated content of oysters.		
		Under 3 inches.	Over 3 inches.	Seed.	Market.	Total.
	Acres.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Dense	328	683	943	224,024	309,304	533,328

DETAILS OF EXAMINATION OF OLD TOWN BED.

Station.	Date of examination.	Depth of water.	Area covered.	Oysters caught per square yard.			Shells per square yard.	Estimated quantity oysters per acre.			Character of oyster growth.
				Spat.	Culls.	Counts.		Seed.	Market.	Total.	
	1913.	*Feet.*	*Sq. yds.*					*Bush.*	*Bush.*	*Bush.*	
25	Mar. 6	5.5	1.99	37.2	27.6	30.2	32	782	729	1,511	Dense.
26	...do.....	7.0	1.34	47.7	34.4	48.5	20	871	1,172	2,043	Do.
57	Mar. 10	7.5	1.34	48.4	21.6	40.9	14	845	1,060	1,905	Do.
58	...do.....	7.5	1.34	23.8	15.6	24.5	13	250	642	892	Do.
60	...do.....	8.0	1.34	40.0	20.4	40.1	15	476	1,038	1,514	Do.
61	...do.....	7.0	1.34	70.1	46.8	60.8	30	1,412	1,576	2,988	Do.
79	Mar. 11	7.0	3.13	26.2	15.0	17.6	7	498	456	954	Do.
81	...do.....	6.5	3.13	20.5	13.4	21.8	16	409	564	971	Do.
88	...do.....	6.5	3.13	25.0	19.8	26.8	22	542	694	1,236	Do.
89	...do.....	6.0	3.91	60.8	20.5	60.8	23	981	1,575	2,556	Do.
117	Mar. 13	7.0	2.34	28.5	42.1	42.1	24	856	1,020	1,876	Do.
165	Mar. 18	7.0	1.79	11.2	12.3	33.0	11	284	796	1,080	Do.

LUMP SOUTH OF OLD TOWN BED.

This small lump, which is about 125 yards south of Old Town Bed and 50 yards from the west shore, contains 14 acres. Two stations were made, each showing a dense growth of clustered oysters, which were more or less covered with yellow sponge. The bottom was hard and the depth of water from 3½ to 5 feet. No work was being conducted on this lump during the survey. The following tables sufficiently indicate its character:

OYSTER GROWTH ON LUMP SOUTH OF OLD TOWN BED.

Character of oyster growth.	Area.	Oysters per acre.		Estimated content of oysters.		
		Under 3 inches.	Over 3 inches.	Seed.	Market.	Total.
	Acres.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Dense	14	499	665	6,986	9,310	16,296

DETAILS OF EXAMINATION OF LUMPS SOUTH OF OLD TOWN BED.

Station.	Date of examination.	Depth of water.	Area covered.	Oysters caught per square yard.			Shells per square yard.	Estimated quantity oysters per acre.			Character of oyster growth.
				Spat.	Culls.	Counts.		Seed.	Market.	Total.	
	1913.	*Feet.*	*Sq. yds.*					*Bush.*	*Bush.*	*Bush.*	
92	Mar. 11	7.0	2.35	18.4	21.0	30.8	10	477	793	1,270	Dense.
118	Mar. 13	5.5	4.17	19.7	23.3	22.3	11	521	538	1,059	Do.

A small lump, covering about 13 acres, lies about a quarter of a mile northwest of this bed, but although its position was determined no examination of the oysters was made.

BED NORTH OF MIDDLE GROUND REEF.

This bed, which has no local name, lies but a short distance to the north of Middle Ground Reef and is approximately 1 mile in length by one-fifth of a mile wide. It is not fished much for the market, as the stock is poor and largely of the sharp-edged long snapper or raccoon type, which occurs in scattering clusters more or less covered with yellow sponge. The average depth of water is about 6½ feet. The bottom varies from almost an ooze to rather hard mud and contains many buried shells. During the last two or three years a new growth has developed on old, partly buried shells south of the middle of the bed. The growth is all rated as dense, and its general condition is shown in the following tables:

OYSTER GROWTH ON BED NORTH OF MIDDLE GROUND REEF.

Character of oyster growth.	Area.	Oysters per acre.		Estimated content of oysters.		
		Under 3 inches.	Over 3 inches.	Seed.	Market.	Total.
	Acres.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Dense	173	410	431	70,930	74,563	145,493

DETAILS OF EXAMINATION OF BED NORTH OF MIDDLE GROUND REEF.

Station.	Date of examination.	Depth of water.	Area covered.	Oysters caught per square yard.			Shells per square yard.	Estimated quantity oysters per acre.			Character of oyster growth.
				Spat.	Culls.	Counts.		Seed.	Market.	Total.	
	1913.	*Feet.*	*Sq. yds.*					*Bush.*	*Bush.*	*Bush.*	
9	Mar. 5	6.5	1.37	14.6	9.5	11.7	1	289	282	571	Dense.
55	Mar. 10	6.5	1.37	43.8	18.3	27.6	15	750	715	1,465	Do.
71	...do....	7.5	1.34	37.2	16.7	36.4	10	651	944	1,595	Do.
132	Mar. 17	7.5	1.79	16.2	13.9	8.9	7	364	215	579	Do.
124	Mar. 14	7.0	....	.0	.0	.0	0	0	0	0	Do.

KELLERS BED.

Kellers Bed begins at the shoal water off Rhodes Point and extends southeastward for 3 miles. At its upper end it is half a mile in width, which gradually broadens to a mile near the center, then narrows rather suddenly to about 300 yards for the rest of its length.

Disregarding the shallow water off Rhodes Point, varying from 1 foot to 2½ feet, and the water immediately south of the point, ranging from 3 to 3½ feet, the average depth of water on the bed approximates 6½ feet.

The bottom is composed generally of hard mud, although four stations made at points along the eastern and southern edges revealed a barren bottom of stiff mud 5 to 8 inches deep, and at three tonging stations the bottom was found to be ooze.

The oysters occur in large, sharp-edged clusters and are generally "snappers" of poor quality, although at some stations well shaped but watery. Oysters were found on the southern end of the bed, which is depleted, the bottom being hard and covered with scattering dead shells on which were but few spats. The bed is not fished much except at the southern end, where, especially during the past two or three years, oysters have grown on shells thrown overboard by boats passing from Sand Point to Kellers Bay. This same condition applies to all parts of the bay, especially the lower end. The general conditions on the bed are shown in the following tables:

Oyster Growth on Kellers Bed.

Character of oyster growth.	Area.	Oysters per acre.		Estimated content of oysters.		
		Under 3 inches.	Over 3 inches.	Seed.	Market.	Total.
	Acres.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Dense[a]	1,275	312	426	397,800	543,150	940,950
Depleted	12	65	0	780	....	780
Total	1,287	....	....	398,580	543,150	941,730

[a] No stations were made on the shore skirting south of Rhodes Point.

DETAILS OF EXAMINATION OF KELLERS BED.

Station.	Date of examination.	Depth of water.	Area covered.	Oysters caught per square yard.			Shells per square yard.	Estimated quantity oysters per acre.			Character of oyster growth.
				Spat.	Culls.	Counts.		Seed.	Market.	Total.	
	1913.	Feet.	Sq. yds.					Bush.	Bush.	Bush.	
6	Mar. 5	7.0	1.79	23.5	10.6	22.9	26	408	553	961	Dense.
7	...do.....	7.0	1.34	10.4	8.9	11.2	13	256	272	528	Do.
8	...do.....	7.0	1.34	17.2	11.9	9.7	11	349	234	583	Do.
39	Mar. 6	7.5	1.79	5.6	6.1	27.9	22	141	674	815	Do.
30	...do.....	8.0	....	.0	.0	.0	0	0	0	0	
53	Mar. 10	8.0	1.34	17.8	13.4	32.7	12	375	847	1,222	Do.
65	...do.....	8.0	1.34	45.4	30.5	64.6	28	934	1,672	2,606	Do.
68	...do.....	7.5	1.34	27.0	14.6	24.8	16	503	643	1,146	Do.
69	...do.....	7.5	1.34	27.0	18.8	28.4	15	554	734	1,288	Do.
125	Mar. 14	8.0	1.79	24.0	16.2	26.8	26	485	646	1,131	Do.
126	...do.....	8.0	....	.0	.0	.0	0	0	0	0	Do.
134	Mar. 17	7.0	1.79	15.1	10.0	28.2	11	303	683	986	Do.
136	...do.....	6.5	1.82	14.3	14.3	17.0	19	346	410	756	Do.
137	...do.....	7.0	1.79	17.9	9.5	24.0	19	332	577	909	Do.
148	...do.....	7.5	1.79	16.2	12.9	24.0	18	352	579	931	Do.
149	...do.....	7.0	....	.0	.0	.0	0	0	0	0	Do.
152	...do.....	3.5	2.92	12.0	8.8	15.4	6	251	372	623	Do.
424	May 7	7.5	1.79	9.8	21.8	19.0	33	382	458	840	Do.
425	...do.....	7.5	1.79	11.7	15.1	19.5	33	324	471	795	Do.
426	...do.....	6.5	1.82	11.0	20.9	12.6	27	385	305	690	Do.
427	...do.....	6.0	1.85	4.8	8.6	10.2	9	185	246	431	Do.
151	May 17	7.5	....	.0	.0	.0	0	0	0	0	Do.
45	Mar. 6	6.0	.93	5.4	.0	.0	18	65	0	65	Depleted.

There is a fringe of oysters occurring more or less regularly along the shore from the outer part of Rhodes Point eastward for about a mile. No stations were made here. A similar skirting is found along the shore north of Cox Bay, and also to the west of Lavaca River.

There is a small patch 90 by 300 yards to the southeast of the main bed with rather hard bottom and scattering clusters in about 6½ feet of water. The area of the patch is about 7 acres, and it is estimated to bear 4,018 bushels of small and 3,444 bushels of market oysters—an average of 574 and 492 bushels per acre, respectively. Some of the shells are more or less covered with a growth of yellow sponge. The oysters are about equal in quality to those of the main bed.

RHODES POINT REEF.

This is a sickle-shaped bed extending from the end of Rhodes Point to the middle of the bay, with a total length of about 3 miles and an average width of somewhat less than one-half mile. The bottom is generally hard with the exception of a few limited areas near the end. The extent and general character of the oyster growth is shown in the following table:

OYSTER GROWTH ON RHODES POINT REEF.

Character of oyster growth.	Area.	Oysters per acre.		Estimated content of oysters.		
		Under 3 inches.	Over 3 inches.	Seed.	Market.	Total.
	Acres.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Dense[a]	1,093	366	565	400,038	617,545	1,017,583
Scattering	121	103	87	12,463	10,527	12,990
Very scattering	3	12	53	36	159	195
Total	1,217	....	....	412,537	628,231	1,030,768

[a] Including a 9-acre detached patch.

With the exception of a scattering growth near the middle of the northern edge of the bed, and a very small patch of very scattering oysters, the entire bed is covered by a dense growth on which there is an average of over 500 bushels of large oysters per acre and a maximum of over 1,200 bushels. There is an abundance of small oysters, but both large and small are in commingled clusters and of poor quality. Mussels were found on the southern part of the reef and there is an abundance of yellow sponge.

The details of the examination of this reef are shown in the following table:

DETAILS OF EXAMINATION OF RHODES POINT REEF.

Station.	Date of examination.	Depth of water.	Area covered.	Oysters caught per square yard.			Shells per square yard.	Estimated quantity oysters per acre.			Character of oyster growth.
				Spat.	Culls.	Counts.		Seed.	Market.	Total.	
	1913.	*Feet.*	*Sq. yds.*					*Bush.*	*Bush.*	*Bush.*	
146	Mar. 17	6.0	1.86	15.7	19.4	40.0	11	425	965	1,390	Dense.
147	...do.....	5.5	1.99	26.2	24.6	48.3	26	614	1,175	1,789	Do.
153	...do.....	5.5	1.99	17.6	27.6	40.0	10	546	966	1,512	Do.
154	...do.....	6.5	1.82	29.6	36.8	50.5	17	803	1,228	2,031	Do.
155	...do.....	8.0	1.79	4.5	17.9	20.8	8	272	503	775	Do.
160	...do.....	8.0	1.79	13.4	16.8	35.8	20	365	865	1,230	Do.
161	...do.....	8.0	1.79	21.8	15.1	25.2	6	506	609	1,115	Do.
163	...do.....	8.0	1.79	7.8	14.5	41.8	15	269	1,010	1,279	Do.
168	Mar. 18	8.0	1.79	11.2	10.6	27.4	17	264	661	925	Do.
170	...do.....	6.0	1.86	25.9	17.7	24.3	11	527	586	1,113	Do.
171	...do.....	5.5	1.99	25.6	4.0	7.0	5	358	169	527	Do.
179	Mar. 27	6.0	1.85	30.2	19.9	15.6	12	606	376	982	Do.
211	Mar. 28	7.5	1.79	3.3	10.0	10.0	6	163	242	405	Do.
255	Apr. 1	8.0	1.79	11.2	6.1	15.1	8	204	364	568	Do.
256	...do.....	7.5	1.79	12.3	14.5	12.3	18	323	297	620	Do.
257	...do.....	7.5	1.79	12.8	5.6	9.5	7	222	247	469	Do.
260	...do.....	8.0	1.79	14.5	15.0	16.8	9	356	405	761	Do.
261	...do.....	8.0	1.79	14.5	12.3	24.5	7	323	592	915	Do.
262	...do.....	8.0	1.79	22.3	13.4	11.2	30	431	270	701	Do.
263	...do.....	8.0	1.79	9.5	11.2	10.6	9	250	258	508	Do.
264	...do.....	8.0	1.79	12.3	12.8	20.6	7	304	496	800	Do.
428	May 7	4.5	1.79	21.8	34.6	40.7	13	680	986	1,666	Do.
460	May 10	8.0	1.79	7.2	4.4	8.9	1	140	214	354	Do.
461	...do.....	7.5	1.79	2.8	11.2	24.6	9	169	594	763	Do.
464	...do.....	6.5	1.82	16.5	16.5	25.8	21	399	624	1,023	Do.
176	Mar. 27	7.0	....	.0	.0	.0	0	0	0	0	Do.
462	May 10	8.0	1.79	9.5	10.6	10.0	7	142	142	284	Scattering.
463	...do.....	8.5	1.79	5.6	8.3	5.0	9	168	121	289	Do.
162	Mar. 17	6.5	....	.0	.0	.0	0	0	0	0	Do.

COX BED.

Cox Bed lies in and off the entrance to Cox Bay, and, like Rhodes Point Reef and Kellers Bed, with which it is continuous, it begins at Rhodes Point, extending north for about a mile and a half, and has a width of approximately the same distance.

On the southern part of the bed at Rhodes Point the depth is from 1 foot to 3½ feet, but the remainder, with few exceptions, has a uniform depth of about 6 feet.

The bottom is generally hard and covered by a dense growth of from about 250 to 550 bushels of market oysters per acre. These occur in scattered clusters and are of poor quality.

The character of the oyster growth is shown in summary and detail in the following tables:

OYSTER GROWTH ON COX BED.

Character of oyster growth.	Area.	Oysters per acre.		Estimated content of oysters.		
		Under 3 inches.	Over 3 inches.	Seed.	Market.	Total.
	Acres.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Dense	1,177	364	358	428,428	421,366	849,794

DETAILS OF EXAMINATION OF COX BED.

Station.	Date of examination.	Depth of water.	Area covered.	Oysters caught per square yard.			Shells per square yard.	Estimated quantity oysters per acre.			Character of oyster growth.
				Spat.	Culls.	Counts.		Seed.	Market.	Total.	
	1913.	*Feet.*	*Sq. yds.*					*Bush.*	*Bush.*	*Bush.*	
184	Mar. 27	6.0	1.85	9.7	16.3	10.2	31	314	246	560	Dense.
185	...do.....	6.5	1.82	26.9	15.1	14.5	6	507	350	857	Do.
186	...do.....	7.0	1.79	26.8	19.0	19.0	24	554	458	1,012	Do.
214	Mar. 28	6.0	1.85	22.6	28.5	22.6	20	616	545	1,161	Do.
215	...do.....	6.0	1.85	21.2	18.9	19.9	8	485	480	965	Do.
216	...do.....	6.0	1.85	6.5	7.5	11.8	8	159	285	444	Do.
217	...do.....	7.5	1.79	10.6	12.8	20.9	10	283	505	788	Do.

Several small lumps east of this bed show oyster growths as follows:

OYSTER GROWTH ON LUMPS EAST OF COX BED.

Character of oyster growth.	Area.	Oysters per acre.		Estimated content of oysters.		
		Under 3 inches.	Over 3 inches.	Seed.	Market.	Total.
	Acres.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Dense [a]	3	423	572	1,269	1,716	2,985
Scattering	31	267	120	8,277	3,720	11,997
Total	34	....	....	9,546	5,436	14,982

[a] Including a 3-acre patch west of main reef.

GALLINIPPER REEF.

This lies immediately adjacent to Gallinipper Point, from which it extends northward to the dredged channel, marked by beacons no. 3 and no. 4. It is somewhat circular in outline, with a diameter of three-fourths of a mile. The eastern portion is covered by 4 feet or less of water, the reef rising rather abruptly 2 feet or more above the general level of the surrounding barren bottom. From the crest of this ridge it slopes westward to the general level of the bottom.

The general conditions on the bed are shown in the following table:

OYSTER GROWTH ON GALLINIPPER REEF.

Character of oyster growth.	Area.	Oysters per acre.		Estimated content of oysters.		
		Under 3 inches.	Over 3 inches.	Seed.	Market.	Total.
	Acres.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Dense [a]	329	766	586	252,014	192,794	444,808
Scattering	32	231	145	7,392	4,640	12,032
Total	361			259,406	197,434	456,840

[a] Including a 3-acre patch west of main reef.

The oysters occur generally in clusters and are of rather poor shape but fair flavor. The reef has not been fished for the market to any extent in recent years, although it produces oysters of fair quality for shucking. Tongers can take but four or five barrels per day, owing to the time consumed in culling. It is understood that oysters from this bed have been used to some extent for seed. There are a few mussels and many barnacles and the yellow sponge is rather common. The details of the examination of this bed are shown in the following table:

DETAILS OF EXAMINATION OF GALLINIPPER REEF.

Station.	Date of examination.	Depth of water.	Area covered.	Oysters caught per square yard.			Shells per square yard.	Estimated quantity oysters per acre.			Character of oyster growth.
				Spat.	Culls.	Counts.		Seed.	Market.	Total.	
	1913.	*Feet.*	*Sq. yds.*					*Bush.*	*Bush.*	*Bush.*	
158	Mar. 17	7.5	1.79	7.8	15.9	26.8	8	286	646	932	Dense.
201	Mar. 28	6.5	1.82	30.1	24.1	24.6	9	654	593	1,247	Do.
202	...do.....	6.5	1.99	34.1	21.6	34.1	10	673	821	1,494	Do.
203	...do.....	5.5	2.12	34.8	46.7	67.0	10	987	1,615	2,602	Do.
265	Apr. 5	7.0	1.79	20.6	39.7	10.6	18	729	258	987	Do.
266	...do.....	7.0	1.79	28.1	34.1	15.1	15	750	364	1,114	Do.
267	...do.....	5.0	2.12	28.3	36.8	20.7	6	784	500	1,284	Do.
268	...do.....	5.0	2.12	32.1	38.7	20.8	15	856	500	1,356	Do.
269	...do.....	5.0	1.59	59.8	82.4	42.1	24	1,719	1,016	2,735	Do.
311	Apr. 14	5.5	1.99	28.6	35.2	31.6	13	580	762	1,342	Do.
312	...do.....	5.5	1.49	65.7	52.4	36.2	13	1,061	874	1,935	Do.
313	...do.....	5.5	1.49	94.0	57.7	21.4	15	1,375	508	1,883	Do.
314	...do.....	7.0	1.79	9.5	19.0	8.4	4	258	185	443	Do.
315	...do.....	7.0	1.79	38.5	18.5	14.5	14	517	350	867	Do.
317	...do.....	5.0	1.59	64.7	50.3	16.3	15	1,043	394	1,437	Do.
316	...do.....	6.5	1.82	10.9	13.6	6.0	17	231	145	376	Scattering.

To the east of Gallinipper Point there is a small lump which covers about 55 acres and is one-half mile long by 200 yards wide. It is but slightly raised above the general bottom level of the bay, excepting the central and southern portions, which have about 1 foot elevation. Depth of water is 6 to 7 feet.

The quality of the oysters is about equal to that of those found on the near-by reef, and there is an average of about 257 bushels per acre.

There are in this immediate vicinity three small patches, which were located by the chain, but the character of the oyster growth was not determined. The area of these patches will total 34 acres.

MITCHELL POINT REEF.

This and Gallinipper Reef form practically one continuous body of oysters and extend almost the entire distance across the bay from Point Comfort to Gallinipper Point. The separation of the two reefs at the channel near beacons no. 3 and no. 4 is arbitrary, as there is no interruption of oyster growth and but little essential difference in the character of the oysters and of the bottom.

The reef runs in a north and south direction and has a length of 3 miles with an average width of 500 yards. At the northern extremity the depth of water varies from 2 to 3½ feet, and on a narrow ridge a mile long, in the center, the depth is from 2 to 4 feet. The average depth for the remainder is about 6 feet. The entire reef is elevated approximately 1 foot above the level of the bay.

The oysters consist largely of clusters, with some singles. It is fished more for planting purposes than for the market, excepting at the northern border, where some good marketable oysters were taken. The reef has never been depleted, excepting a small portion on the northeast side.

At most of the stations from 1 to 6 mussels were found, and near the center of the reef from 25 to 55 barnacles were noted at the tonging stations.

The general conditions on this bed are shown in the following tables:

OYSTER GROWTH ON MITCHELL POINT REEF.

Character of oyster growth.	Area.	Oysters per acre.		Estimated content of oysters.		
		Under 3 inches.	Over 3 inches.	Seed.	Market.	Total.
	Acres.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Dense	532	998	737	520,956	392,084	913,040
Scattering	39	84	127	3,276	4,953	8,229
Very scattering	19	205	48	3,895	912	4,807
Total	590			528,127	397,949	926,076

DETAILS OF EXAMINATION OF MITCHELL POINT REEF.

Station.	Date of examination.	Depth of water.	Area covered.	Oysters caught per square yard.			Shells per square yard.	Estimated quantity oysters per acre.			Character of oyster growth.
				Spat.	Culls.	Counts.		Seed.	Market.	Total.	
	1913.	*Feet.*	*Sq. yds.*					*Bush.*	*Bush.*	*Bush.*	
166	Mar. 18	5.5	1.99	55.2	42.2	49.7	12	1,177	1,204	2,381	Dense.
174	Mar. 27	5.0	2.12	50.9	41.5	28.3	11	163	684	847	Do.
175	...do.....	5.0	2.12	109.8	66.1	35.8	18	2,120	864	2,984	Do.
190	...do.....	5.0	1.59	81.6	48.4	34.6	19	1,565	836	2,401	Do.
210	Mar. 28	4.0	2.65	34.7	35.9	35.9	9	852	866	1,718	Do.
220	...do.....	5.5	1.99	45.6	18.1	47.7	8	772	1,151	1,923	Do.
232	Mar. 29	3.0	2.39	34.7	51.2	47.3	12	1,038	1,140	2,178	Do.
258	Apr. 1	6.0	1.85	38.1	25.4	32.8	8	751	791	1,542	Do.
306	Apr. 14	6.5	1.82	31.8	25.9	7.7	12	525	186	711	Do.
307	...do.....	6.0	1.86	40.8	48.4	20.2	15	809	487	1,296	Do.
308	...do.....	5.0	2.12	68.4	66.9	69.8	32	1,240	1,688	2,928	Do.
309	...do.....	6.0	1.86	41.4	33.4	16.7	9	680	404	1,084	Do.
310	...do.....	7.0	1.79	37.4	32.4	10.1	7	634	244	878	Do.
319	...do.....	5.0	2.12	23.1	12.3	11.7	19	321	282	603	Do.
320	...do.....	3.5	2.19	79.0	42.5	38.8	7	1,103	936	2,039	Do.
321	Apr. 15	6.0	1.86	10.2	12.9	8.6	6	279	208	487	Do.
322	...do.....	4.0	2.65	93.2	34.6	29.3	13	1,544	708	2,252	Do.
323	...do.....	4.5	2.39	87.1	74.1	40.5	25	1,958	979	2,937	Do.
324	...do.....	5.0	2.12	49.5	18.9	25.5	14	826	616	1,442	Do.
325	...do.....	3.5	2.92	82.1	31.7	23.9	8	1,686	577	2,263	Do.
326	...do.....	4.5	2.39	46.4	28.1	25.9	17	915	625	1,540	Do.
191	Mar. 27	7.0	1.79	6.1	5.6	6.1	2	137	147	284	Scattering.
228	Mar. 29	6.5	1.82	.0	2.7	4.4	8	32	107	139	Do.
318	Apr. 14	5.5	1.99	10.0	12.1	2.0	10	205	48	253	Very scattering.

Between Mitchell Point Reef and the entrance to Chocolate Bay lies a small lump, 150 yards by 300 yards in extent. The oysters of this lump are of poor quality, clustered, and of the snapper type; they are not fished for market.

POINT COMFORT BEDS.

Within the limits of these beds, which lie one-half mile northwest of Point Comfort, there are six lumps, one large and five small ones. The largest is roughly heart-shaped and is about one-third mile by one-half mile in extent, while the others are small irregular patches.

On the large lump two stations were made, both of which showed comparatively soft bottoms. At one station the oysters were scattering and on black shells in soft mud; at the other there were large irregular clusters. A station made on the small lump north of the largest revealed a soft bottom and shells burrowed by the little boring clam *Martesia*. There were many mussels and also some barnacles and yellow sponge. The oysters of these beds are of new growth and have not been fished for the market.

The remaining four lumps, comprising 24 acres, were located and have been plotted on the chart, but the character and quality of the oysters were undetermined. The following tables furnish further data of a general character.

OYSTER GROWTH ON POINT COMFORT BEDS.

Character of oyster growth.	Area.	Oysters per acre.		Estimated content of oysters.		
		Under 3 inches.	Over 3 inches.	Seed.	Market.	Total.
	Acres.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Dense	116	358	184	41,528	21,344	62,872
Scattering[a]	10	302	127	3,020	1,270	4,290
Total	126			44,548	22,614	67,162

[a] An adjacent lump.

DETAILS OF EXAMINATION OF POINT COMFORT BEDS.

Station.	Date of examination.	Depth of water.	Area covered.	Oysters caught per square yard.			Shells per square yard.	Estimated quantity oysters per acre.			Character of oyster growth.
				Spat.	Culls.	Counts.		Seed.	Market.	Total.	
	1913.	*Feet.*	*Sq. yds.*					*Bush.*	*Bush.*	*Bush.*	
284	Apr. 12	5.0	2.12	32.1	11.8	8.5	11	398	186	584	Dense.
459	May 9	6.0	1.86	1.6	24.7	7.5	14	318	183	501	Do.
285	Apr. 12	4.0	2.65	15.5	17.8	6.0	3	302	127	429	Scattering.

LAP REEF.

Lap and Chicken Reefs together stretch almost entirely across the constricted portion of the upper bay, off Nobles Point, and form practically a line of demarcation in the character and quality of the oysters of the lower and upper parts of the bay. The two reefs are separated by a narrow channel from 7 to 9 feet deep, bearing the local name of "Hole in the Wall."

Lap Reef begins 200 yards off Nobles Point and reaches to the northward for a mile and a quarter. It reaches its maximum width of about 800 yards at the northern extremity and gradually tapers to a point at the southern end.

On the eastern half of the reef the depth of water ranges from 1½ to 4 feet, several feet less than the adjacent barren bottom. The depth on the southern and western parts ranges from 3½ to 6 feet, being about equal to that of the surrounding bottom of the bay. The oysters occur as singles and in small clusters and generally are of excellent flavor; some were used as shell stock in 1912. This reef has been fished for the last seven or eight years, and will now yield about 4 barrels per day. It has never been depleted.

There are many mussels and some barnacles on this reef. The general extent and condition of the bed are shown in the following table:

OYSTER GROWTH ON LAP REEF.

Character of oyster growth.	Area.	Oysters per acre.		Estimated content of oysters.		
		Under 3 inches.	Over 3 inches.	Seed.	Market.	Total.
	Acres.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Dense	194	576	333	111,744	64,602	176,346
Scattering[a]						
Very scattering	14	376	73	5,164	1,022	6,186
Depleted	33	99	3	3,267	99	3,366
Total	241			120,175	65,723	185,898

[a] Counted in with dense.

DETAILS OF EXAMINATION OF LAP REEF.

Station.	Date of examination.	Depth of water.	Area covered.	Oysters caught per square yard.			Shells per square yard.	Estimated quantity oysters per acre.			Character of oyster growth.
				Spat.	Culls.	Counts.		Seed.	Market.	Total.	
	1913.	*Feet.*	*Sq. yds.*					*Bush.*	*Bush.*	*Bush.*	
292	Apr. 12	4.0	2.65	63.7	12.1	16.5	6	688	352	1,040	Dense.
327	Apr. 15	5.5	1.99	28.1	25.1	8.0	2	642	231	873	Do.
417	May 6	6.5	1.82	30.9	42.7	14.8	12	891	357	1,248	Do.
419	...do.....	5.5	1.99	6.5	12.6	19.1	3	253	462	715	Do.
420	...do.....	5.0	2.12	15.6	24.5	12.7	16	484	307	791	Do.
421	...do.....	4.5	2.39	34.8	23.4	23.0	18	702	556	1,258	Do.
422	...do.....	4.5	2.39	16.3	9.6	10.8	4	312	261	573	Do.
297	Apr. 12	3.5	2.92	45.5	25.0	6.5	3	640	138	778	Scattering.
296	...do.....	3.5	2.92	32.9	8.5	3.4	10	376	73	449	Very scattering.
418	May 6	6.5	1.82	.5	14.6	.0	20	182		182	Depleted.
423	...do.....	4.5	2.39	.0	9.6	.4	4	116	10	126	Do.
293	Apr. 12	6.0		.0	.0	.0	0	0	0	0	Do.

CHICKEN REEF.

This begins at the channel—the "Hole in the Wall"—from which it extends in an easterly direction to the shoal water of a projecting point of the east shore. The reef is long, narrow, and with a slight dip southward near the center. The length is approximately 1½ miles, while the average width is about 200 yards.

The depth of water varies from 1 foot to 5 feet, averaging about 3 feet; there are two narrow ridges, one at the western and the other at the eastern extremity, which are awash at low tide. Other than at the eastern limit, where the depths on and near the bed are practically the same and do not exceed 3½ or 4 feet, this reef is markedly shoaler than the surrounding parts of the bay. Like all such elevated reefs, its mass is composed of compacted shells and débris, the accumulation of many years of existence.

The character of these oysters is about the same as those of Lap Reef. On the top of the reef there were fine white shells, and some excellent oysters in the guts near shore, but they have been practically fished out.

OYSTER GROWTH ON CHICKEN REEF.

Character of oyster growth.	Area.	Oysters per acre.		Estimated content of oysters.		
		Under 3 inches.	Over 3 inches.	Seed.	Market.	Total.
	Acres.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Dense	88	305	252	26,840	22,176	49,016
Scattering	40	252	110	10,080	4,400	14,480
Very scattering	20	82	49	1,640	980	2,620
Depleted	12	22	5	264	60	324
Total	160	....	....	38,824	27,616	66,440

DETAILS OF EXAMINATION OF CHICKEN REEF.

Station.	Date of examination.	Depth of water.	Area covered.	Oysters caught per square yard.			Shells per square yard.	Estimated quantity oysters per acre.			Character of oyster growth.
				Spat.	Culls.	Counts.		Seed.	Market.	Total.	
	1913.	*Feet.*	*Sq. yds.*					*Bush.*	*Bush.*	*Bush.*	
449	May 9	3.5	2.92	18.3	16.8	6.5	10	424	154	578	Dense.
450	...do.....	4.5	2.39	15.1	13.4	12.5	4	344	302	646	Do.
451	...do.....	6.0	1.86	4.8	7.5	12.4	11	148	300	448	Do.
452	...do.....	4.0	2.66	7.2	23.7	3.8	6	373	91	464	Scattering.
453	...do.....	3.5	2.92	10.3	15.4	5.8	13	310	140	450	Do.
457	...do.....	3.5	2.92	.0	6.2	4.1	3	75	99	174	Do.
448	...do.....	4.5	2.39	2.9	5.4	2.5	10	100	61	161	Very scattering.
454	...do.....	4.5	2.39	1.6	3.8	1.6	2	65	38	103	Do.
455	...do.....	4.0	2.66	.0	3.8	.4	9	44	10	....	Depleted.
456	...do.....	3.5	2.92	.0	.0	.0	0	0	0	....	Do.

North of the barrier of these cross reefs the salinity of the water is reduced and the mussels become more numerous and, contrary to the accepted view that barnacles occur more frequently in waters of higher salinity, the reverse was found to be true in Lavaca Bay.

There is a small patch one-half mile north of the western extremity of Chicken Reef. It is practically circular in outline, having a diameter of 175 yards. Depth of water 5 feet. An examination showed an average of about 323 bushels of market oysters and 253 bushels of small ones per acre, the area of the patch being about 8 acres.

BEDS NORTHWEST OF LAP REEF.

About three-quarters of a mile northwest of Lap Reef there are three beds, two of which are small, varying from 250 to 350 yards in length, while the third is about three-fourths of a mile long, and narrow, excepting near the northern margin, where it broadens to a width of 500 yards.

The depth of water ranges from 4 to 5½ feet and the beds are but little elevated above the adjacent bottom. The patch nearest to the west shore bears scattering clusters of large oysters of the snapper type, with some mussels and barnacles, and the second lump showed a better growth of oysters, but twice the number of mussels and barnacles. On the large patch five stations were made, showing oysters, together with a large number of mussels and barnacles. At two of these stations on the widest part of the patch the bottom was rather soft, and some of the shells were black, having been taken from below the surface. This bed is fished but little and consequently not much is known about it. It will probably not yield more than 4 or 5 barrels per man per day.

Three additional beds of 44 acres were located in the vicinity of the large patch, but no investigations were made on them.

The following tables exhibit the results of the examination of these beds:

OYSTER GROWTH ON BEDS NORTHWEST OF LAP REEF.

Character of oyster growth.	Area.	Oysters per acre.		Estimated content of oysters.		
		Under 3 inches.	Over 3 inches.	Seed.	Market.	Total.
	Acres.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Dense	79	328	295	25,912	23,305	49,217

DETAILS OF EXAMINATION OF BEDS NORTHWEST OF LAP REEF.

Station.	Date of examination.	Depth of water.	Area covered.	Oysters caught per square yard.			Shells per square yard.	Estimated quantity oysters per acre.			Character of oyster growth.
				Spat.	Culls.	Counts.		Seed.	Market.	Total.	
	1913	*Feet.*	*Sq. yds.*					*Bush.*	*Bush.*	*Bush.*	
298	Apr. 12	5.0	2.12	5.2	8.0	7.1	7	129	152	281	Dense.
411	Apr. 29	6.0	1.86	23.6	31.7	22.6	25	668	546	1,214	Do.
412	...do.....	5.5	1.99	4.0	3.0	12.6	9	85	305	390	Do.
413	...do.....	6.5	1.82	18.1	12.1	9.3	5	374	224	598	Do.
414	...do.....	6.5	1.82	18.7	20.9	14.3	21	478	344	822	Do.
415	...do.....	6.0	1.86	16.6	30.0	20.2	8	563	486	1,049	Do.

CHAIN BEDS.

These beds, 12 in number, lie off Signal Bay and, with one exception, are small isolated patches, none of which have a local name. The depth varies from 3½ to 5 feet with an elevation of from one-half to 1 foot above the surrounding bottom. Four beds were examined. The largest of the series has a length of 1 mile and a width of 350 yards, and on this five stations were made. The southern end showed about 24 counts, 14 culls, 41 spat, and 90 mussels per square yard; near the center of the bed the bottom was rather soft, with some mussels, barnacles, and buried shells along with the oysters; at the northern end there were about 7 counts, 8 culls, and 4 spat per square yard, also some buried shells. This bed is fished but little, although the oysters are of fair flavor. The first small lump of 6 acres north of the large patch produced mostly singles, rather small, but of extra fine shape and good quality, probably the best of the entire bay. This lump yielded 18 counts, 17 culls, and 20 spat per square yard. The second lump north of the large patch yielded scattering clusters, mussels, barnacles, and dead shells in black mud, and another lump south of Benado Creek Reef produced 34 counts, 56 culls, and 37 spat, with some mussels and barnacles per square yard.

These small patches are all fished for the market. The remaining lumps, containing 31 acres, were located, but the character of the oyster growth was not determined.

OYSTER GROWTH ON CHAIN BEDS.

Character of oyster growth.	Area.	Oysters per acre.		Estimated content of oysters.		
		Under 3 inches.	Over 3 inches.	Seed.	Market.	Total.
	Acres.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Dense	94	483	496	45,402	46,624	92,026
Scattering	29	27	105	783	3,045	3,828
Total	123	....	....	46,185	49,669	95,854

DETAILS OF EXAMINATION OF CHAIN BEDS.

Station.	Date of examination.	Depth of water.	Area covered.	Oysters caught per square yard.			Shells per square yard.	Estimated quantity oysters per acre.			Character of oyster growth.
				Spat.	Culls.	Counts.		Seed.	Market.	Total.	
	1913.	*Feet.*	*Sq. yds.*					*Bush.*	*Bush.*	*Bush.*	
352	Apr. 16	5.0	2.12	41.0	13.8	24.1	17	662	583	1,245	Dense.
354	...do....	5.5	1.99	12.6	23.6	20.1	9	437	485	922	Do.
361	Apr. 17	4.0	2.65	19.9	16.9	18.0	6	334	435	769	Do.
367	...do....	2.5	2.64	37.1	55.7	34.1	12	845	822	1,667	Do.
430	May 8	6.5	1.82	3.8	7.7	6.6	11	139	159	298	Do.
355	Apr. 16	6.0	1.86	.0	.5	4.8	27	6	116	122	Scattering.
369	Apr. 17	5.0	2.12	.0	.0	3.3	....	0	79	79	Do.
429	May 8	6.0	1.85	.5	5.9	5.0	8	77	121	198	Do.

HOPPE LUMP.

Hoppe lump lies three-quarters of a mile north of Signal Bay, and about 175 yards off the west shore. The lump is approximately 500 yards wide and 700 yards long and is somewhat quadrate in outline. The depth of water varies from 3 to 5 feet and the northernmost part of the lump rises from one-half to 1 foot above the general level of the neighboring bottoms.

Three stations were made. One near the west-central margin revealed a soft bottom, some buried shells, but no oysters; another near the center of the lump showed a rather soft bottom, but 21 counts, 54 mussels, and 35 barnacles per square yard; while the third station, near the southern margin, showed a hard bottom with 3 counts and 3 mussels per square yard.

The oysters of this lump are in clusters and singles, long, flat, and with sharp edges but of fair flavor. It is fished but little.

OYSTER GROWTH ON HOPPE LUMP.

Character of oyster growth.	Area.	Oysters per acre.		Estimated content of oysters.		
		Under 3 inches.	Over 3 inches.	Seed.	Market.	Total.
	Acres.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Dense	41	75	198	3,075	8,118	11,193

DETAILS OF EXAMINATION OF HOPPE LUMP.

Station.	Date of examination.	Depth of water.	Area covered.	Oysters caught per square yard.			Shells per square yard.	Estimated quantity oysters per acre.			Character of oyster growth.
				Spat.	Culls.	Counts.		Seed.	Market.	Total.	
	1913.	*Feet.*	*Sq. yds.*					*Bush.*	*Bush.*	*Bush.*	
445	May 8	6.5	1.82	4.3	13.7	21.4	22	218	516	734	Dense.
444	...do....	6.5	1.82	.0	.0	.0	0	0	0	0	Do.
372	Apr. 17	5.5	2.12	.0	.9	3.3	1	8	79	....	Scattering.

HALF MOON REEF.

This lies one-half mile south of Long Reef and a quarter of a mile north of Hoppe Lump. Its length is one-half mile, and its greatest width, 300 yards, is near the southern half, whence it contracts suddenly to the northward to a width of 50 yards.

The depth of water ranges from 3 to 5 feet, and the reef is approximately on the general level of the surrounding bottoms, excepting along the western margin, where there is an elevation of about 1 foot.

Three stations were made, one on the 50-yard projection, which gave the best returns—about 11 counts, 3 culls, and 6 spat per square yard. An average of the other stations near the center of the reef showed 4 counts, 3 culls, and 4 spat. Mussels and barnacles were found at all stations.

The oysters of this reef resemble those of Hoppe Lump. They are of fair flavor, of good shape, but generally too small for market, excepting on the edges, where they occur in clusters. They sell for 98 cents per barrel, 2 cents tax. The reef was first fished in 1910, and the work has been carried on during most of the present season (1912–13). One man can tong seven barrels per day. During "northers" the reef is liable to become dry.

As a rule, fishing does not begin in the upper bay until October. However, if freshets are early and the weather becomes cool, fishing is pursued earlier.

OYSTER GROWTH ON HALF MOON REEF.

Character of oyster growth.	Area.	Oysters per acre.		Estimated content of oysters.		
		Under 3 inches.	Over 3 inches.	Seed.	Market.	Total.
	Acres.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Dense	33	78	151	2,574	4,983	7,557

DETAILS OF EXAMINATION OF HALF MOON REEF.

Station.	Date of examination.	Depth of water.	Area covered.	Oysters caught per square yard.			Shells per square yard.	Estimated quantity oysters per acre.			Character of oyster growth.
				Spat.	Culls.	Counts.		Seed.	Market.	Total.	
	1913.	*Feet.*	*Sq. yds.*					*Bush.*	*Bush.*	*Bush.*	
441	May 8	6.0	1.39	5.7	2.9	10.8	25	104	261	365	Dense.
377	Apr. 17	4.5	2.39	7.5	3.3	4.6	5	98	111	209	Scattering.
442	May 8	5.5	1.49	.0	2.7	3.4	9	33	82	115	Do.

LONG REEF.

This long, narrow, crescent-shaped reef of 64 acres lies a few hundred yards southeast of the mouth of Garcitas Bay and has a length of 1 mile, with an average width of about 150 yards. It is practically at the level of the general bottom, excepting at the western extremity, where there is a rise of about 6 inches. The depth of water varies from 3½ to 4 feet.

Along the edge of the reef there are large oysters in clusters resembling those on Half Moon Reef, while on top there are small ones. Considerable fishing is done here for seed, which are worth as much as marketable oysters. Permits are obtained to take whatever is on the bottom without the payment of any tax. This reef was first fished about two years ago, and, with the exception of Chicken Reef, this is true for the upper bay generally. One man can take seven barrels per day.

A small patch of 3 acres, 100 by 200 yards in extent, lies just east of Long Reef and has dense oysters of about the same character and quality as those of the main reef. The depth of water varies from 3½ to 4 feet. A station on the patch showed 705 bushels of seed and 1,122 bushels of marketable oysters per acre, making, all told, for the patch 2,115 bushels of seed and 3,366 bushels of marketable oysters.

The following tables show the data obtained from this bed:

Oyster Growth on Long Reef.

Character of oyster growth.	Area.	Oysters per acre.		Estimated content of oysters.		
		Under 3 inches.	Over 3 inches.	Seed.	Market.	Total.
	Acres.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Dense	64	340	332	21,760	21,248	43,008

Details of Examination of Long Reef.

Station.	Date of examination.	Depth of water.	Area covered.	Oysters caught per square yard.			Shells per square yard.	Estimated quantity oysters per acre.			Character of oyster growth.
				Spat.	Culls.	Counts.		Seed.	Market.	Total.	
	1913.	*Feet.*	*Sq. yds.*					*Bush.*	*Bush.*	*Bush.*	
382	Apr. 17	4.5	2.39	15.1	13.8	18.8	3	262	454	716	Dense.
396	Apr. 25	2.5	3.52	4.0	5.7	14.9	6	117	360	477	Do.
437	May 8	3.0	2.39	19.3	22.2	9.6	15	501	232	733	Do.
440	...do.....	5.5	1.49	47.8	16.3	19.5	41	774	471	1,245	Do.
438	...do.....	5.5	1.99	.0	4.0	6.0	1	48	145	193	Scattering.

PATCHES NEAR SIGNAL GAR.

There are two small patches in the vicinity of Signal Gar, about 250 yards offshore and three-quarters of a mile off Long Reef. They are each about 150 yards in length by 100 yards in width. Depth 2½ feet.

The patch to the west, containing 3 acres, was discovered in 1911, but first fished the year following. The oysters on top are very dense and are of the snapper type. On the southeast edge there are large oysters in mud; the other edges do not bear such good stock, but better than is found on top. As many as 18 barrels have been fished in one day and at least 200 barrels of oysters have been taken in one week. The oysters are of good quality and fair flavor, but too large for raw stock.

The patch to the east, containing 2 acres, is fished but little, and not at all last season. The oysters are dense and in clusters, but scattering on the edges, and are not up to the standard, being of poor shape, watery, and poor in flavor and meat.

Oyster Growth on Patches near Signal Gar.

Character of oyster growth.	Area.	Oysters per acre.		Estimated content of oysters.		
		Under 3 inches.	Over 3 inches.	Seed.	Market.	Total.
	Acres.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Dense	5	1,027	1,088	5,135	5,440	10,575

DETAILS OF EXAMINATION OF PATCHES NEAR SIGNAL GAR.

Station.	Date of examination.	Depth of water.	Area covered.	Oysters caught per square yard.			Shells per square yard.	Estimated quantity oysters per acre.			Character of oyster growth.
				Spat.	Culls.	Counts.		Seed.	Market.	Total.	
	1913.	*Feet.*	*Sq. yds.*					*Bush.*	*Bush.*	*Bush.*	
435	May 8...	4.0	2.61	21.1	26.3	29.3	21	572	708	1,280	Dense.
436	...do....	4.0	1.99	70.7	53.2	60.8	35	1,483	1,468	2,951	Do.
399	Apr. 25..	3.5	....	.0	.0	.0	0	0	0	0	

BENADO CREEK REEF.

Benado Creek Reef lies approximately 1 mile southwest of the mouth of Benado Creek, and one-half mile off the north shore of the bay. The reef is 1 mile in length and about 300 yards in width at the central section, narrowing to both the north and south. The depth of water on and adjacent to the reef ranges from 3½ to 5 feet.

This reef was first fished in 1910–11, but has never been given a fair test because oysters are more plentiful elsewhere. Three or four barrels is considered a good day's yield per man. The oysters are of fair shape, occurring mostly in clusters, and are of fair flavor. The reef never ebbs dry.

The following tables show its area and distribution of oyster growth:

OYSTER GROWTH ON BENADO CREEK REEF.

Character of oyster growth.	Area.	Oysters per acre.		Estimated content of oysters.		
		Under 3 inches.	Over 3 inches.	Seed.	Market.	Total.
	Acres.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Dense..	39	257	333	10,023	12,987	23,010
Scattering....................................	15	17	92	255	1,380	1,635
Very scattering............................	20	0	24	0	480	480
Total....................................	74	....	....	10,278	14,847	25,125

DETAILS OF EXAMINATION OF BENADO CREEK REEF.

Station.	Date of examination.	Depth of water.	Area covered.	Oysters caught per square yard.			Shells per square yard.	Estimated quantity oysters per acre.			Character of oyster growth.
				Spat.	Culls.	Counts.		Seed.	Market.	Total.	
	1913.	*Feet.*	*Sq. yds.*					*Bush.*	*Bush.*	*Bush.*	
384	Apr. 17	4.0	2.66	20.2	13.9	12.0	3	315	289	604	Dense.
416	Apr. 30	4.5	2.39	7.9	10.9	17.2	5	243	415	658	Do.
432	May 8	5.0	2.12	6.6	10.4	12.7	5	205	306	511	Do.
433	...do....	5.0	2.12	.0	1.4	3.8	6	17	92	109	Scattering.
431	...do....	6.0	1.85	.0	.0	1.0	2	0	24	24	Very scattering.

PATCHES BETWEEN BENADO CREEK AND LAVACA RIVER.

Between Benado Creek and Lavaca River there are seven rather small patches which were located during the survey, but only two of these were examined in detail.

The first patch, about 1⅓ miles southeast of the mouth of Benado Creek and 700 yards off the east shore, is 100 yards wide by 200 yards long. A station made on this patch revealed a hard bottom and about 425 bushels of seed and 754 bushels of market oysters per acre, the depth of the water being 3 feet.

The second patch examined lies one-third of a mile south of the first, and about 400 yards off the east shore. It is somewhat circular in outline, but with a projecting arm and a slight indentation on the eastern margin. The diameter is approximately 300 yards and the depth of water 3 feet.

An examination of this patch showed about 443 bushels of small oysters and 578 bushels of large ones per acre. On both patches the oysters are larger than on the lumps to the westward, but they are fished but little.

There is a fringe of oysters covering upward of 100 acres along shore north of the mouth of Lavaca River, but no detailed examination was made.

OYSTER GROWTH ON PATCHES BETWEEN BENADO CREEK AND LAVACA RIVER.

Character of oyster growth.	Area.	Oysters per acre.		Estimated content of oysters.		
		Under 3 inches.	Over 3 inches.	Seed.	Market.	Total.
	Acres.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Dense	22	443	578	9,746	12,716	22,462

DETAILS OF EXAMINATION OF PATCHES BETWEEN BENADO CREEK AND LAVACA RIVER.

Station.	Date of examination.	Depth of water.	Area covered.	Oysters caught per square yard.			Shells per square yard.	Estimated quantity oysters per acre.			Character of oyster growth.
				Spat.	Culls.	Counts.		Seed.	Market.	Total.	
	1913.	*Feet.*	*Sq. yds.*					*Bush.*	*Bush.*	*Bush.*	
446	May 8	5.0	1.59	13.2	22.0	31.2	8	425	754	1,179	Dense.
447	...do....	4.0	1.99	13.6	24.6	16.6	8	461	402	863	Do.

REVIEW OF THE NATURAL OYSTER BEDS.

Of the total area of Lavaca Bay, about one-sixth, 6,853 acres, or 10.7 square miles, is covered with oyster growth. In the lower half of the bay the beds, with the exception of some insignificant patches, are all east of a line joining Gallinipper Point and Point Comfort.

Why the western third of this region should be barren while the remainder is covered by extensive and prolific beds was not determined by the survey. The beds are practically continuous and in many cases the lines of demarcation between them are arbitrarily assumed for the purposes of this report.

In the upper part of the bay, above the line between Noble Point and Point Comfort, the beds are smaller and more generally distributed, although somewhat more numerous in the western half. So far as the quality of the oysters is concerned, their flavor, condition, and to some extent their shape, those of the upper bay were the better during the time of the survey and it is probable that this is true at most times.

In respect to the uniform prolificness of the beds as a whole, Lavaca Bay is the most remarkable region which has been surveyed by the Bureau. Not less than 91 per cent of the total area of oyster bottom is classed as dense growth, 5 per cent as scattering, a little over 2 per cent as very scattering, and a little less than 2 per cent as so-called depleted bottom. It appears as if the bottom must spring into great productivity very soon after it begins to bear oysters at all, and the large areas of sparsely productive bottom usually found in oyster-producing regions are lacking.

A glance at the chart accompanying this report will show this, and it is also exhibited in the following table which shows the acreage of each class of growth for each of the large beds and for groups of the smaller patches.

Summarized Statement of Areas of Market Oysters on Public Beds.

Name of bed.	Character of oyster growth.				Total.
	Dense.	Scattering.	Very scattering.	Depleted.	
	Acres.	*Acres.*	*Acres.*	*Acres.*	*Acres.*
Sand Point Reef	78	....	20	62	160
Lumps northeast of Sand Point Reef	5	....	67	....	72
Middle Ground Reef	444	28	....	....	472
Old Town Bed	328	....	....	....	328
Lumps south of Old Town Bed	14	....	....	....	14
Bed north of Middle Ground	173	....	....	....	173
Kellers Bed	1,275	....	....	12	1,287
Rhodes Point Reef	1,093	121	3	....	1,217
Cox Bed	1,177	....	....	....	1,177
Lumps east of Cox Bed	3	31	....	....	34
Gallinipper Reef	329	32	....	....	361
Mitchell Point Reef	532	39	19	....	590
Point Comfort Beds	116	10	....	....	126
Lap Reef	194	....	14	33	241
Chicken Reef	88	40	20	12	160
Northwest of Lap Reef	79	....	....	....	79
Chain Beds	94	29	....	....	123
Hoppe Lump	41	....	....	....	41
Half Moon Reef	33	....	....	....	33
Long Reef	64	....	....	....	64
Patches near Gar Signal	5	....	....	....	5
Benado Creek Reef	39	15	20	....	74
Between Benado Creek and Lavaca River	22	....	....	....	22
Total	6,226	345	163	119	6,853

As is explained in the introductory part of the report, the classification is based on the relative abundance of oysters over 3 inches long, which is assumed to be the minimum size which could be used for market purposes. The smaller oysters, while recorded and elsewhere discussed, do not enter in any way into the classification. Neither does the term dense mean a continuous cover of massed oysters. It is used to express the condition where oysters in excess of 150 bushels per acre are found on the bottom, either as a continuous growth or in separated clusters, lying on the mud or sand.

The following table gives the estimated total content of each class of growth of each bed:

Summarized Content of Market Oysters on Public Beds.

Name of bed.	Character of oyster growth.				Total.
	Dense.	Scattering.	Very scattering.	Depleted.	
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Sand Point Reef	16,536		1,140	372	18,048
Lumps northeast of Sand Point Reef	3,055		2,680		5,735
Middle Ground Reef	426,240	3,836			430,076
Old Town Bed	309,304				309,304
Lumps south of Old Town Bed	9,310				9,310
Bed north of Middle Ground	74,563				74,563
Kellers Bed	543,150				543,150
Rhodes Point Reef	617,545	10,527	159		628,231
Cox Bed	421,366				421,366
Lumps east of Cox Bed	1,716	3,720			5,436
Gallinipper Reef	192,794	4,640			197,434
Mitchell Point Reef	392,084	4,953	912		397,949
Point Comfort Beds	21,344	1,270			22,614
Lap Reef	64,602		1,022	99	65,723
Chicken Reef	22,176	4,400	980	60	27,616
Northwest of Lap Reef	23,305				23,305
Chain Beds	46,624	3,045			49,669
Hoppe Lump	8,118				8,118
Half Moon Reef	4,983				4,983
Long Reef	21,248				21,248
Patches near Gar Signal	5,440				5,440
Benado Creek Reef	12,987	1,380	480		14,847
Between Benado Creek and Lavaca River	12,716				12,716
Total	3,251,206	37,771	7,373	531	3,296,881

This table shows an extraordinary average of 525 bushels of large oysters per acre of the areas classed as bearing a dense growth and of nearly 500 bushels per acre for the entire area of oyster beds in the bay. Therefore, not only is the ratio of dense growth to the whole greater, but the density of growth on that area and on the beds as a whole is much greater than in any other region of approximately equal extent which has been examined by the Bureau.

Middle Ground and Old Town Beds are the most productive, each producing over their extensive areas an average of about 950 bushels of large oysters per acre. This is exceeded slightly by some of the small lumps in the upper part of the bay. This, however, constitutes but part of the oyster content, for the smaller oysters are numerically more numerous than the larger ones and as a whole approximately equal them in bulk, as is shown in the following table:

SUMMARIZED CONTENT OF YOUNG OYSTERS ON PUBLIC BEDS.

Name of bed.	Character of oyster growth.				Total.
	Dense.	Scattering.	Very scattering.	Depleted.	
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Sand Point Reef	26,208		12,080	8,432	46,720
Lumps northeast of Sand Point Reef	3,310		28,542		31,852
Middle Ground Reef	359,196	21,308			380,504
Old Town Bed	224,024				224,024
Lumps south of Old Town Bed	6,986				6,986
Bed north of Middle Ground	70,930				70,930
Kellers Bed	397,800			789	398,580
Rhodes Point Reef	400,038	12,463	36		412,537
Cox Bed	428,428				428,428
Lumps east of Cox Bed	1,269	8,277			9,546
Gallinipper Reef	252,014	7,392			259,406
Mitchell Point Reef	520,956	3,276	3,895		528,127
Point Comfort Beds	41,528	3,020			44,548
Lap Reef	111,744		5,164	3,267	120,175
Chicken Reef	26,840	10,080	1,640	264	38,824
Northwest of Lap Reef	25,912				25,912
Chain Beds	45,402	783			46,185
Hoppe Lump	3,075				3,075
Half Moon Reef	2,574				2,574
Long Reef	21,760				21,760
Patches near Gar Signal	5,135				5,135
Benado Creek Reef	10,023	255			10,278
Between Benado Creek and Lavaca River	9,746				9,746
Total	2,994,898	66,854	51,357	12,743	3,125,852

Although in a sense the young oysters are the most important elements of the reef contents, they have no immediate commercial value except as seed. It is not until they grow to market size that they can be used, and as they grow it is self-evident that the number per bushel will decrease. A comparison of their quantity with that of the market oysters is therefore less important as an index of the probable future of a reef than an examination of their relative numbers, and for the purpose of making this numerical comparison the following table has been prepared from the data collected by the survey.

NUMBER OF OYSTERS UNDER THREE INCHES LONG FOR EACH ONE OVER THAT LENGTH ON THE SEVERAL BEDS.

Name of bed.	Character of oyster growth.			
	Dense.	Scattering.	Very scattering.	Depleted.
Sand Point Reef	7.6		2.3	45.0
Lumps northeast of Sand Point Reef	2.3		26.7	
Middle Ground Reef	1.7	11.2		
Old Town Bed	1.6			
Lumps south of Old Town Bed	1.5			
Bed north of Middle Ground	2.0			
Kellers Bed	1.3			No large.

NUMBER OF OYSTERS UNDER THREE INCHES LONG FOR EACH ONE OVER THAT LENGTH ON THE SEVERAL BEDS—Continued.

Name of bed.	Character of oyster growth.			
	Dense.	Scattering.	Very scattering.	Depleted.
Rhodes Point Reef	1.3	2.3	....	....
Cox Bed	2.6	....	....	....
Lumps east of Cox Bed	1.5	4.4	....	....
Gallinipper Reef	2.9	4.1	....	....
Mitchell Point Reef	3.0	1.4	11.0	....
Point Comfort Beds	4.4	5.6	....	....
Lap Reef	3.7	....	12.1	61.8
Chicken Reef	2.4	4.6	3.3	9.5
Northwest of Lap Reef	2.2	....	....	....
Chain Beds	2.2	.5	....	....
Hoppe Lump	.8	....	....	....
Half Moon Reef	.8	....	....	....
Long Reef	2.3	.6	....	....
Patches near Gar Signal	1.9	....	....	....
Benado Creek Reef	1.7	.4	....	....
Between Benado Creek and Lavaca River	1.5	....	....	....

On all beds except Hoppe Lump and Half Moon Reef there is a considerable numerical preponderance of small oysters, and in consideration of the rapidity of oyster growth on the Gulf coast there is no probability that any of the beds will fail to perpetuate themselves under present conditions, unless as the result of physical accident or the attacks of some enemy which has not yet appeared.

BARREN BOTTOMS.

The area of barren bottoms—that is, those which are not naturally productive of oysters even in small quantities—vastly exceeds that of the natural beds, including in the latter those so-called depleted areas which bear practically nothing. These bottoms are barren, mainly because of one character in which they differ from the productive areas namely, that they are devoid of shells or other objects lying on the surface. They consist of sand and mud of varying degrees of stability and consistency. Oysters, immediately after they develop from the egg, for a brief period swim or float freely in the water, settling to a fixed condition only after they reach a stage of considerable development.[a]

It is not necessary to give more detail to this subject other than to say that at the time at which they are undergoing fixation the oysters are very minute, and a slight film of mud or slime is sufficient to stifle them. During the spawning season these little organisms are present in the water in untold myriads and are precipitated to the bottom in a continuous gentle drizzle of tiny specks. If they fall on an oyster bed they find firm supports on the shells and oysters, attach themselves and grow, but if they fall on the mud or bare sand they die.

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[a] For a more extended account see "Oysters and methods of oyster culture," by H. F. Moore, Bureau of Fisheries Document no. 349, which may be obtained by application to the Bureau at Washington, D. C.

The natural beds have been slowly developed on bottom similar to that which surrounds them solely because through some agency there originally lodged on the mud or sand some hard objects to which the young oysters could safely cling. Oysters developing there and their shells scattered about by the waves furnished additional places for fixation of new generations of young, with the result that the original growth extended in area and its bed became a compact mass of shells and fragments, beneath which can still be found by excavation or probing the original bottom differing in no essential particular from the adjacent barren areas.

All that is required by the barren bottom in order that it may become productive is that its surface should be supplied with hard objects or cultch, either through natural agencies or by the hand of man. The capacity of the bottom to sustain material deposited on it and to maintain it in proper condition to serve as cultch depends largely on its stability and consistency. Moving sands gradually cover objects deposited on their surface and soft mud permits them to sink. It is therefore of prime importance for the oyster culturist to have information concerning the character of the bottom, and it was one of the purposes of the survey to supply it.

The methods and the instrument employed have been described in the introductory part of this report and the results attained are shown graphically on the chart.

The symbols on the chart designating the character of the bottom do not show all of the places at which examinations were made, but only those which have been selected as representative of the general conditions obtaining in the vicinity. It may be assumed that between any two adjacent symbols of different significance the change in the character of the bottom is more or less gradual.

While practically none of the bottom of Lavaca Bay is composed of ooze, practically all of it, except in places alongshore and in the immediate vicinity of the reefs, is composed of soft or very soft mud, which under the economic conditions of the locality are hardly worthy of serious consideration for purposes of oyster culture.

The bottoms which are classed in this report as hard and stiff mud are more or less scattered along the margins of the bay, usually within one-half mile of shore. The largest body of bottom naturally firm enough for planting oysters without danger of having them engulfed and smothered is in the southeastern part of the bay between Sand Point and the mouth of Kellers Bay. The location of other areas may be most readily determined from the chart.

GENERAL PHYSICAL AND BIOLOGICAL CONDITIONS.

TIDES AND CURRENTS.

Primarily for the reduction of the soundings to approximate mean low-water level, a tide gauge, a plain staff graduated in feet and tenths, was established at Port Lavaca, the most convenient and central point on the bay. During the entire period of the survey readings were made every two hours during daylight. The highest tide recorded was on April 23, when the water stood at 4.7 feet on the gauge and the lowest was on March 16, when it fell to 1.2 feet on the staff, a maximum range of 3.5 feet. The daily range was usually from 0.4 to 0.8 feet, and was to a great degree affected by the winds, which in many cases obscured or obliterated the apparent lunar influences.

Although the normal tidal range is small, the currents are sufficiently strong to insure ample circulation for the conveyance of oyster food and the renewal of water for respiratory purposes.

SALINITY AND TEMPERATURE OF THE WATER.

As the amount of salt carried by the waters is a factor important to oyster growth and flavor, as well as conditioning the presence or absence of destructive enemies, a series of observations relating to the salinity and water temperature were continued throughout the survey. It is well known that oysters reach their maximum development and finest quality in waters of brackish character, having a specific gravity of 1.012 to 1.018, about midway between fresh water (specific gravity 1.000) and open-sea water (specific gravity 1.025). Water nearly fresh, on the one hand, or very salt, on the other, if present for any length of time over the oyster beds, is extremely detrimental, if not absolutely prohibitive, to the mollusks. Certain enemies of the oysters are also greatly influenced by the amount of salt in solution, the drill, for example, avoiding waters of low salinity, while the common black sea mussel thrives in them.

In order to obtain a reasonably accurate or reliable estimate of the proportion of salt in Lavaca Bay, two separate but simultaneous series of observations of salinity and water temperature were made. From the *Fish Hawk*, anchored in the vicinity of the Middle Ground and Sand Point Reefs, observations were made at 8 a. m., noon, and 6 p. m. The depth of water varied from 8 to 10 feet. The other series was made by the biological party, and extended over the greater part of the bay, including points both on the reefs and barren grounds.

The water samples in both series of observations were taken a few inches from the bottom of the bay, regardless of depth. The instrument or apparatus used for collecting the samples is illustrated and described in "Volumetric Studies of the Food and Feeding of Oysters," by H. F. Moore (Bulletin Bureau of Fisheries, vol. XXVIII, p. 1297–1308).

For purposes of comparison the bay was divided into three areas of approximately equal extent, the first of which was that section of the lower bay extending northward to a line connecting Rhodes and Gallinipper Points; the second from this line to Chicken and Lap Reefs; the third from these reefs to the head of the bay. The following table summarizes the results of the observations, the boldface type showing the data obtained by the *Fish Hawk* at the mouth of the bay, coincidently with the conditions observed in the several regions by the survey party.

SALINITY AND TEMPERATURE OBSERVATIONS IN LAVACA BAY.

Locality.	Date.	Water temperature.			Specific gravity.		
		Max.	Min.	Av.	Max.	Min.	Av.
	1913.	°F.	°F.	°F.			
Fish Hawk	Feb. 24–28	**66**	**59**	**63**	**1.0176**	**1.0166**	**1.0172**
Fish Hawk	Mar. 1–5	**66**	**59**	**61**	**1.0172**	**1.0160**	**1.0168**
Area 1, vicinity of Kellers Bed	Mar. 5	......	......	64	....	....	1.0166
Fish Hawk	Mar. 6–10	**66**	**57**	**64**	**1.0184**	**1.0156**	**1.0173**
Area 1, vicinity of Old Town, Middle Ground, Kellers Beds.	do	66	63	64	1.0178	1.0152	1.0160
Fish Hawk	Mar. 11–17	**68**	**54**	**61**	**1.0176**	**1.0142**	**1.0164**
Area 1, southeast Gallinipper Point, entrance Kellers Bay; southeast Old Town Bed, east of Kellers Bed.	do	68	57	60	1.0178	1.0147	1.0153
Fish Hawk	Mar. 18–31	**72**	**57**	**65**	**1.0208**	**1.0154**	**1.0176**
Area 2, vicinity of Cox Bed, Mitchell Point Reef, off Chocolate Bay, off Port Lavaca.	do	64	57	61	1.0164	1.0112	1.0130
Fish Hawk	Apr. 1–9	**73**	**68**	**71**	**1.0185**	**1.0160**	**1.0173**
Area 2, vicinity of Rhodes Point Reef, off Port Lavaca, entrance Chocolate Bay.	do	70	66	69	1.0152	1.0134	1.0140
Fish Hawk	Apr. 10–15	**70**	**61**	**66**	**1.0178**	**1.0154**	**1.0168**
Area 2, vicinity of Mitchell Point Reef, south of Chicken Reef, Lap Reef.	do	72	63	67	1.0138	1.0063	1.0116
Fish Hawk	Apr. 16–May 2	**75**	**61**	**70**	**1.0187**	**1.0152**	**1.0169**
Area 3, off Lavaca River, Hoppe Lump, Benado Creek.	do	75	66	73	1.0137	0.0110	1.0120

From this table it will be observed that while there was the usual seasonal increase in the temperature during the progress of the investigation, there was no material change in the saltness of the water at the mouth of the bay, nor, probably, in the other regions. There was, however, a progressive decrease in the salinity of the water from the mouth of the bay to its head, a condition to be expected from the fact that the fresh water is all discharged in the upper part of the bay. At no time during the survey did the saltness fall below that which oysters will tolerate indefinitely, and at no time was it below the most desirable degree of salinity, with the exception of a short period in the first half of April. It is probable, however, that during times of prolonged rainfall some of the oysters in the upper part of the bay may be killed or injured by excessively fresh water.

OYSTER ENEMIES.

Comparatively few oyster enemies were observed during the survey and there was but little evidence of any considerable destruction of oysters through their agency. Probably more oysters are destroyed by mud, or through being overgrown and smothered by their own kind, than are killed by other marine animals.

Drills or conchs.—There occur in Lavaca Bay two species of these marine snails, known to zoologists as *Thais hæmastoma* var. *floridana* and *Busycon perversum*, the former being the more common and larger species, one specimen taken measuring over 4 inches in length. Not over two or three dozen of both kinds were found during the survey and practically no oysters killed by them were found. These drills are essentially salt-water animals and are confined to the lower part of the bay. It is commonly supposed by oystermen that they secrete an acid by which they perforate the oyster shells by solution, but in reality the holes are made mechanically by means of a rasp-like tongue which can be protuded from the mouth.

Mussels (*Mytilus hamalus*).—The mussels found on the oyster beds must not be confused with either the large edible sea mussel of the Atlantic coast or the fresh-water mussel, which is used for button making. So far as is known this species has no present economic use, although doubtless it would make a good fertilizer.

Mussels were found very sparingly on the beds of the lower half of the bay and none at all were observed below a line uniting Gallinipper and Rhodes Points. From Chicken and Lap Reefs northward they became more abundant, and on some beds 100 or more were found within an area of 2 or 3 square yards. This increased abundance is correlated with the lowered salinity of the water, this mussel being an inhabitant of brackish waters. Although this mollusk is classed as an oyster enemy, it is not one in the sense of preying on the more valuable shellfish. It is injurious in that it eats the same kind of food as the oyster, and therefore lessens the supply for the latter, while at the same time its more prolific growth enables it to cover the latter, interfere with its growth and eventually to stifle and starve it.

Drumfish (*Pogonias cromis*).—The black drum was not observed during the survey, nor was it learned that it had ever caused destruction in Lavaca Bay. It is mentioned here because it is likely to appear suddenly on any part of the coast and at such times it is often very destructive, particularly to the planted oysters of better quality. Owing to the clustered growth and sharp edges of the oysters the natural beds of Lavaca Bay are not likely to be seriously injured by this fish.

Minor enemies and pests.—The yellow sponge, which overgrows the oysters and produces the "worm-eaten" condition of the shells, barnacles which crowd the oysters and roughen the shells, and the little boring clam, *Martesia*, which burrows its oval chamber in the shells, are all more or less nuisances, and therefore objectionable, but they do comparatively little harm in Lavaca Bay.

SPAWNING.

The conditions of spawning probably do not differ from those generally obtaining on the Gulf coast, and it is, therefore, not necessary to discuss the subject at any length. It will suffice to repeat what has been said in a previous report.[a]

The spawning of oysters consists, in brief, of the discharge of eggs from the female and spermatozoa from the male to meet and fuse in the surrounding water. The fertilized eggs develop into minute embryos, each furnished with a little brush of cilia or hairlike processes which vibrate in rhythm and propel it feebly through the water. After a time varying with the temperature of the water the embryos develop a tiny shell, which by its weight eventually precipitates them to the bottom, where, if they fall upon a suitable, clean, firm, support, they attach and grow into spat, but if not they speedily die. As their own powers of locomotion are inconsiderable, the wide distribution of the young oysters in their swimming stage is dependent upon the currents.

Oysters in the spawning condition are of a peculiar creamy color, with branching lines traced over the surfaces of the body. When they are cut the ripe genital products at once exude from the wound, but if the shell be opened carefully and a gentle pressure exerted upon the body they will be discharged from a definite opening lying below the muscle (usually called by the oystermen the "eye" or "heart") which extends between the two valves. This is the pore from which they flow in the normal process. Ripe oysters in the language of the oystermen are aptly described as "milky."

Spawning takes place, in the main, during spring and summer, in any given region extending over a period of some months, depending upon the latitude and the climate. On the Gulf coast I have found during almost every month oysters which were apparently ripe, and from which there were obtained eggs which readily separated in the water and had every appearance of maturity. Whether such eggs would be extruded during the winter under natural conditions is doubtful, and if they were it is practically certain that they would not develop, as the experience of all investigators has shown that development is inhibited if the temperature of the water drops materially below 70°.

In Lavaca Bay the critical temperature is not permanently passed until about May, and the major part of the spawning undoubtedly takes place between May 1 and October 1.

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[a] Oyster bottoms in Matagorda Bay. By H. F. Moore. Bureau of Fisheries Document no. 610. 1905.

OYSTER CULTURE.

One of the primary purposes of the survey was to determine the reasons for the unsatisfactory results heretofore attained in oyster culture in the bay and to suggest measures to alleviate the difficulties enumerated. The reasons are apparent, the principal if not the sole difficulty being that the bay is already much overstocked with oysters on the natural reefs.

In summarizing the conditions on the oyster beds it has been shown that they bear, as a whole, an average of nearly 1,000 bushels of oysters per acre, about equally divided between small and market stock.

The beds are also unusually extensive as compared with the barren bottoms, and this, in connection with their productiveness, produces a condition of overpopulation such as the Bureau has not encountered in any other region of even approximately such large extent. The survey showed that for each acre of Lavaca Bay's area of about 60 square miles there were upward of 165 bushels of oysters, large and small. In some localities this would be regarded as a good average productiveness of the beds themselves, which would be surrounded by large areas of barren bottom serving as food reservoirs.

The important effects of this overpopulation of the waters are twofold. In the first place any circumscribed bay or estuary can produce but a more or less definite maximum quantity of oyster food, and, theoretically at least, there will be a definite limited quantity available for each oyster living therein. As a fact, some of the oysters, by virtue of their more favorable location on the bottom, will probably get much more than their fellows, but if there be four or five times as many oysters as there should be, few or none will get enough to eat and all, or practically all, will be poor and of little value in the markets. Under the conditions prevailing in Lavaca Bay this will obtain not only with the oysters on the densely crowded beds, but also to a slightly reduced extent with such oysters as may be laid down on the barren bottoms. The food of the oyster consists of minute plants and finely divided organic matter generally, and as it is water-borne, carried from place to place by the currents, the excessive consumption of food in one place must make itself felt in other places more or less remote.

The second effect of the prodigious population of the natural beds on planted oysters is that the latter become overburdened and eventually overgrown with young oysters; 6,500,000 bushels of oysters in the circumscribed limits of Lavaca Bay must produce spawn in such volume that at the height of the season there are hundreds of oyster embryos in each quart of water. As the region is not subject to the cold rains and sudden chilling of the water which is so destructive to fry near the northern limit of the oyster's range, and as there are no unusual enemies to the tiny free-swimming embryos, they pass through their development in vast numbers and set on every available suitable body exposed to the water, the shells of the planted stock being no exception.

Under such conditions, however carefully the seed may have been culled into singles and small clusters, each becomes a center of attachment for new growth, and there is soon produced a bunch of oysters, none of which has room to grow into good shape, as a planted oyster should in order to bring the price necessary to pay for the expense of planting. Not only are the oysters so produced inferior in shape, but they are invariably poor in quality, as the conditions under which they grow are such that they are unable to get the proper amount of nutriment for the same reasons causing the impoverishment of the food supply of oysters on the natural beds.

The difficulties recounted appear to be insuperable under the conditions at present obtaining. In places where currents slacken and silt deposits the difficulty with the set on the old oysters would be somewhat reduced but not overcome, for the rapid production of new shell characteristic of the region would continually supply clean material on which the spat could settle. Moreover, in such locations the poverty of food would almost invariably be accentuated.

Under the circumstances the best thing which could happen to the oyster fishery would be the very material or even drastic depletion of every oyster bed in the bay. If they contained one-fifth or, perhaps better, one-tenth of their present content, they would produce more marketable oysters than they do at present. According to the data adduced in this report, they contained in the season 1912–13 about eight times the quantity of large oysters which were marketed from the beds of the entire State in the preceding year and a corresponding surplus of young oysters. Here is a case in which the principles of true conservation demand destruction rather than preservation, and cull laws and other measures designed to protect the natural beds would work harm rather than good. Some efficient oyster enemies would be a blessing, provided, of course, that their ravages could be repressed at the critical time when their work had progressed to the proper point.

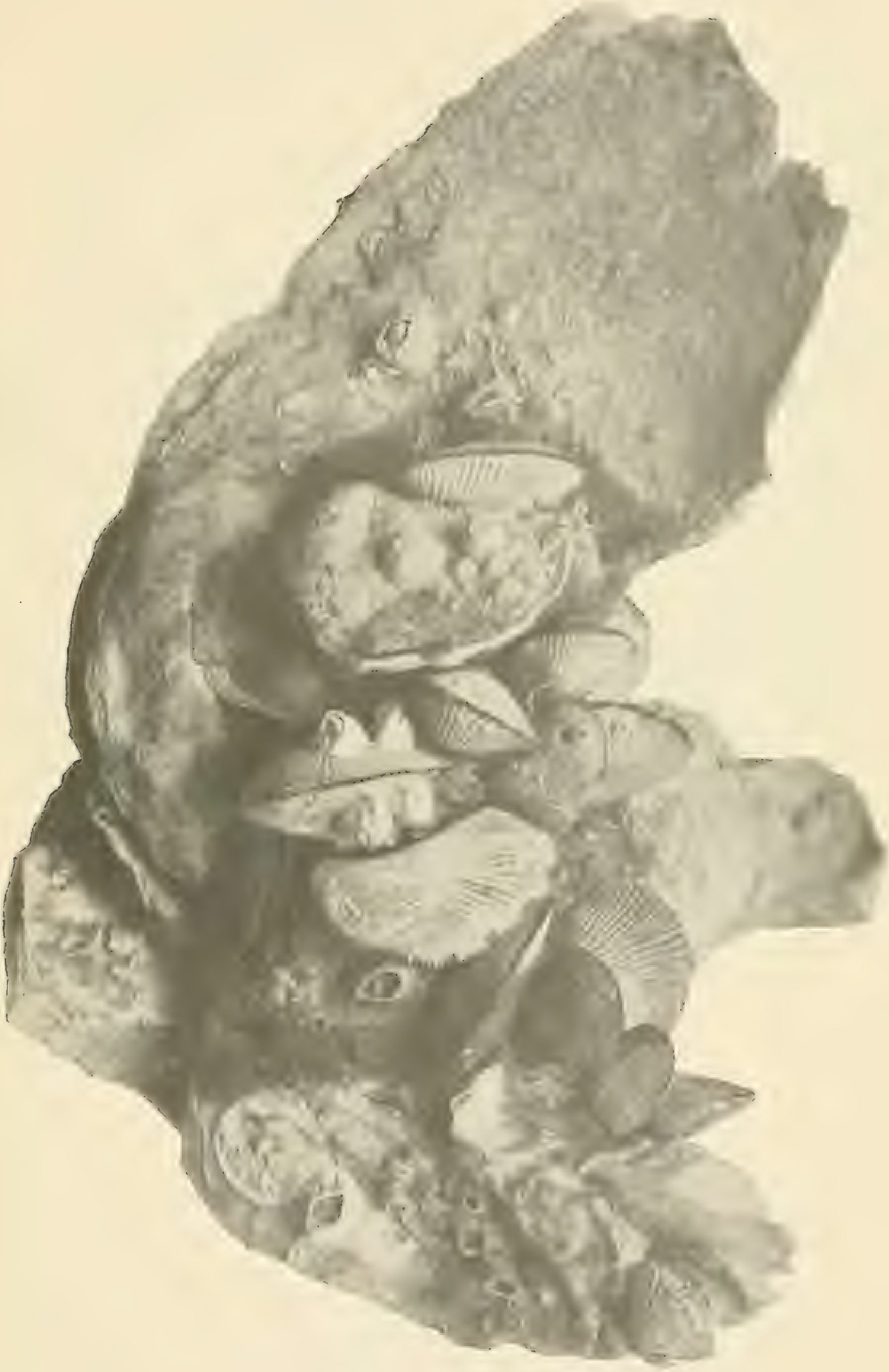
As has been pointed out in several places in this report, the conditions are unusual and the only practical suggestion which the authors have to offer is that those desiring to engage in oyster culture take the oysters from the reefs without regard to size, break up the clusters and plant them in some other region where oysters are not abundant. Possibly the more open waters of Matagorda Bay might be utilized for this purpose, but we are not informed as to the suitability of the bottoms there, and there may be difficulties due to other conditions.

In any event, we do not recommend oyster culture in Lavaca Bay so long as the present dense oyster population is maintained.

RÉSUMÉ, CONCLUSIONS, AND RECOMMENDATIONS.

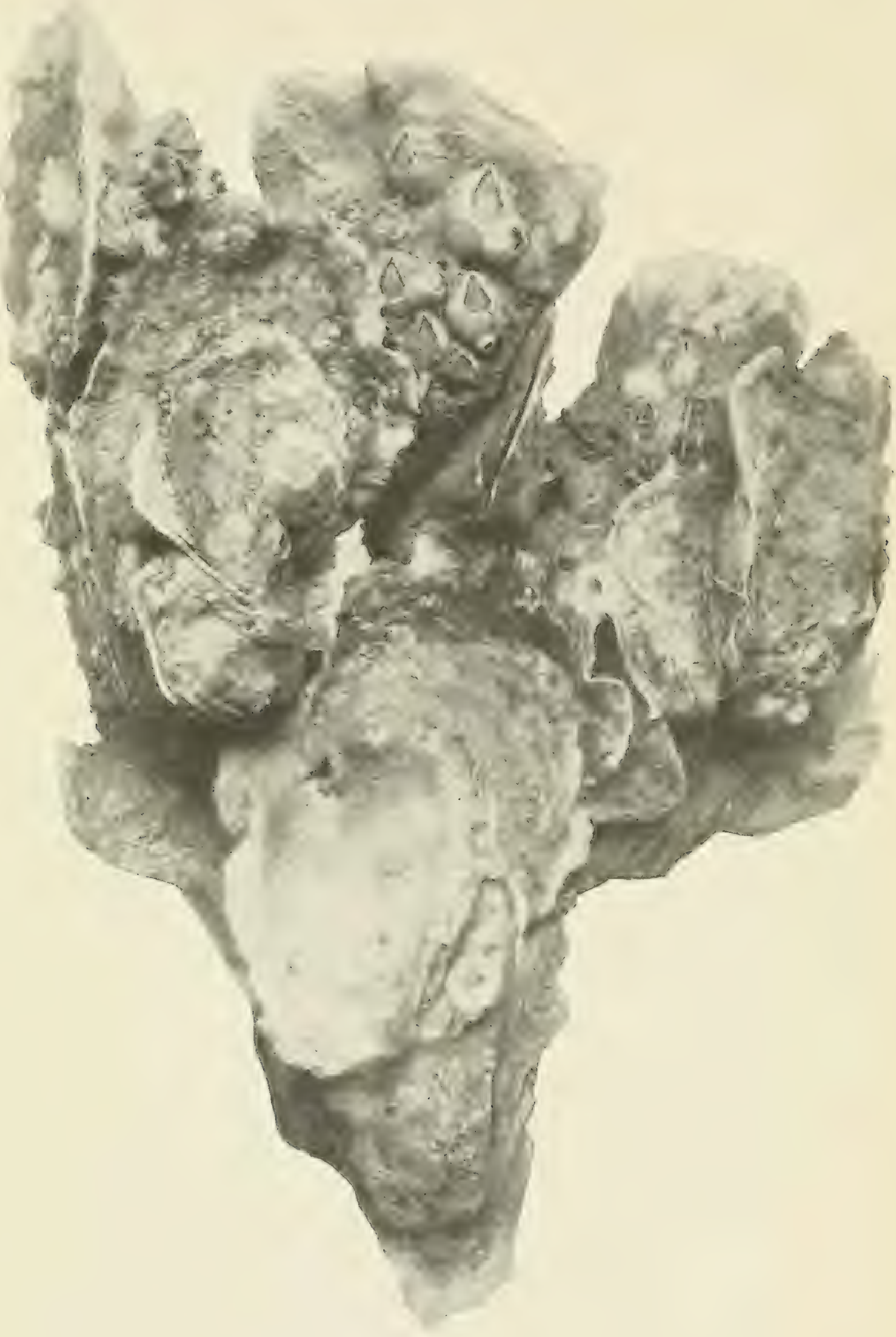
The following is a synopsis of the results of the survey detailed in the foregoing report, with the conclusions and recommendations based on them:

1. The survey covered the entire area of Lavaca Bay, approximately 38,103 acres, or nearly 60 square miles.
2. The area covered by oyster beds was found to be 6,853 acres, about 18 per cent of the entire bay. Of this, about 6,571 acres, or 96 per cent, bore oysters in sufficient quantity to make tonging profitable, provided a market could be found for the product.
3. It is estimated that during the winter 1912–13 the content of these beds was 3,296,881 bushels of oysters over 3 inches long and 3,125,852 bushels of smaller ones.
4. Although the quantities of the two classes of oysters were approximately equal, the small oysters were in considerable numerical preponderance. There is, therefore, no reason to believe that there is imminent any decrease in the present population of the beds except as the result of the operation of wholly unforeseen agencies, such as extraordinary freshets or the inroads of hosts of oyster enemies.
5. The beds are, at present, greatly overpopulated, and this, in connection with their great extent in comparison with the area of the bay, militates against the production of high-grade oysters in any considerable quantities. The oyster industry would be benefited if the oyster population in the bay could be reduced from one-fifth to one-tenth of its present size. For this reason it is recommended that cull laws and other usual measures to preserve the oysters on the natural beds be repealed or otherwise suspended until such time as the content of the beds shall be materially reduced.
6. While there is considerable bottom in Lavaca Bay suitable for oyster culture, it is not believed that the industry can be profitably pursued until the content of the natural beds is greatly reduced. Under present conditions the supply of food is insufficient for the proper feeding of the oyster population, and the purposes of oyster culture, the production of a superior oyster, can not be achieved. The enormous fecundity of the beds, furthermore, makes it difficult or impossible to grow oysters of fine shape. Possibly seed oysters taken from the reefs could be planted to advantage in Matagorda Bay, but lack of information as to the general conditions of that body of water causes the suggestion to be made with some hesitancy.



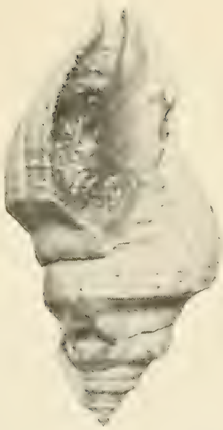
PLANTED OYSTERS, UPPER BAY, WITH MUSSELS AND BARNACLES.

(Natural size.)



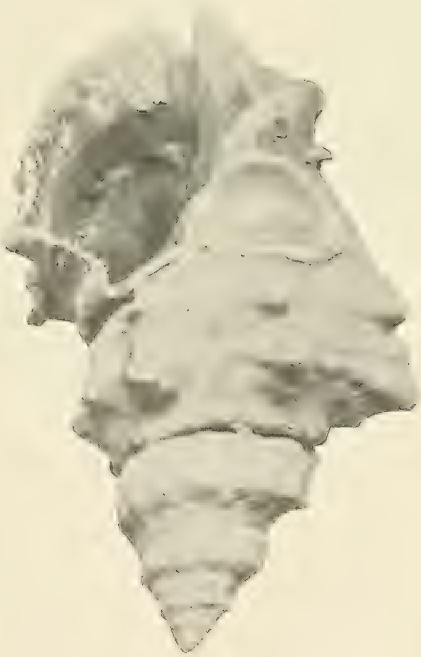
CLUSTER OF NINE MARKETABLE OYSTERS FROM OLD TOWN BED.

(Three-fifths natural size.)



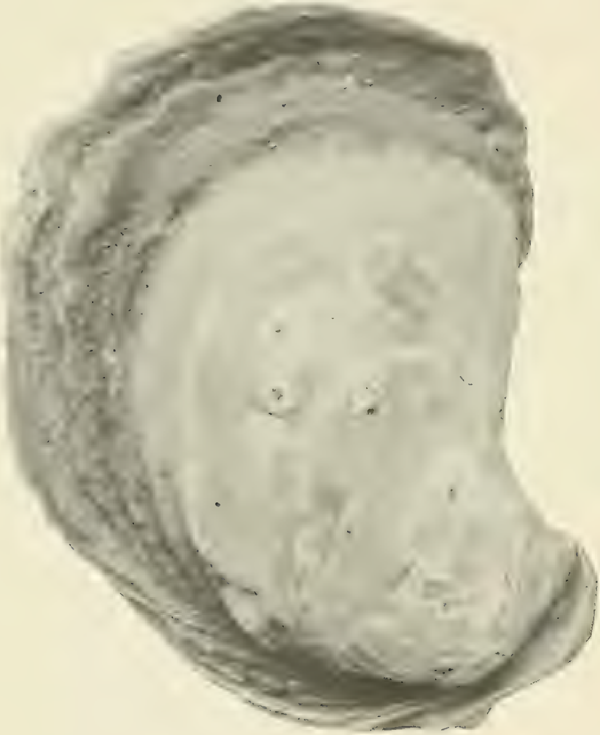
1. YOUNG DRILL (THAIS HÆMASTOMA VAR. FLORIDANA).

(Natural size.)



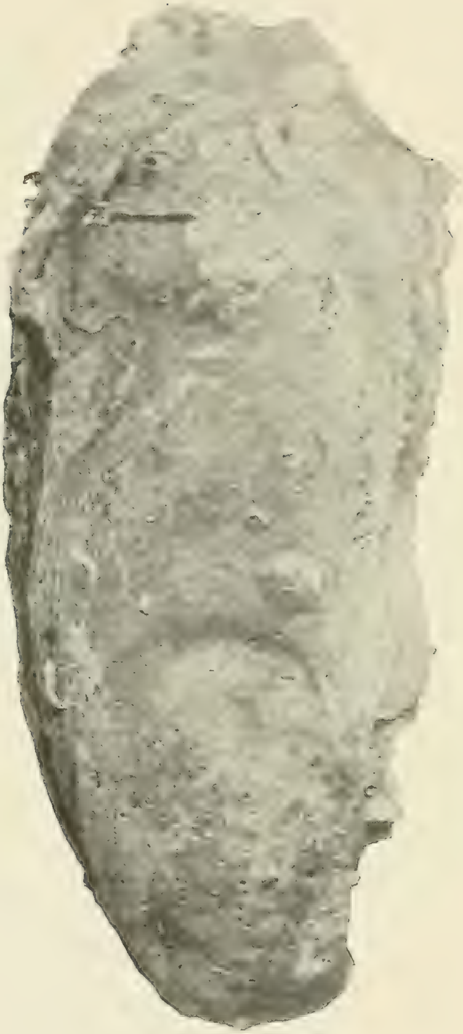
2. ADULT DRILL (THAIS HÆMASTOMA VAR. FLORIDANA)

(Natural size.)



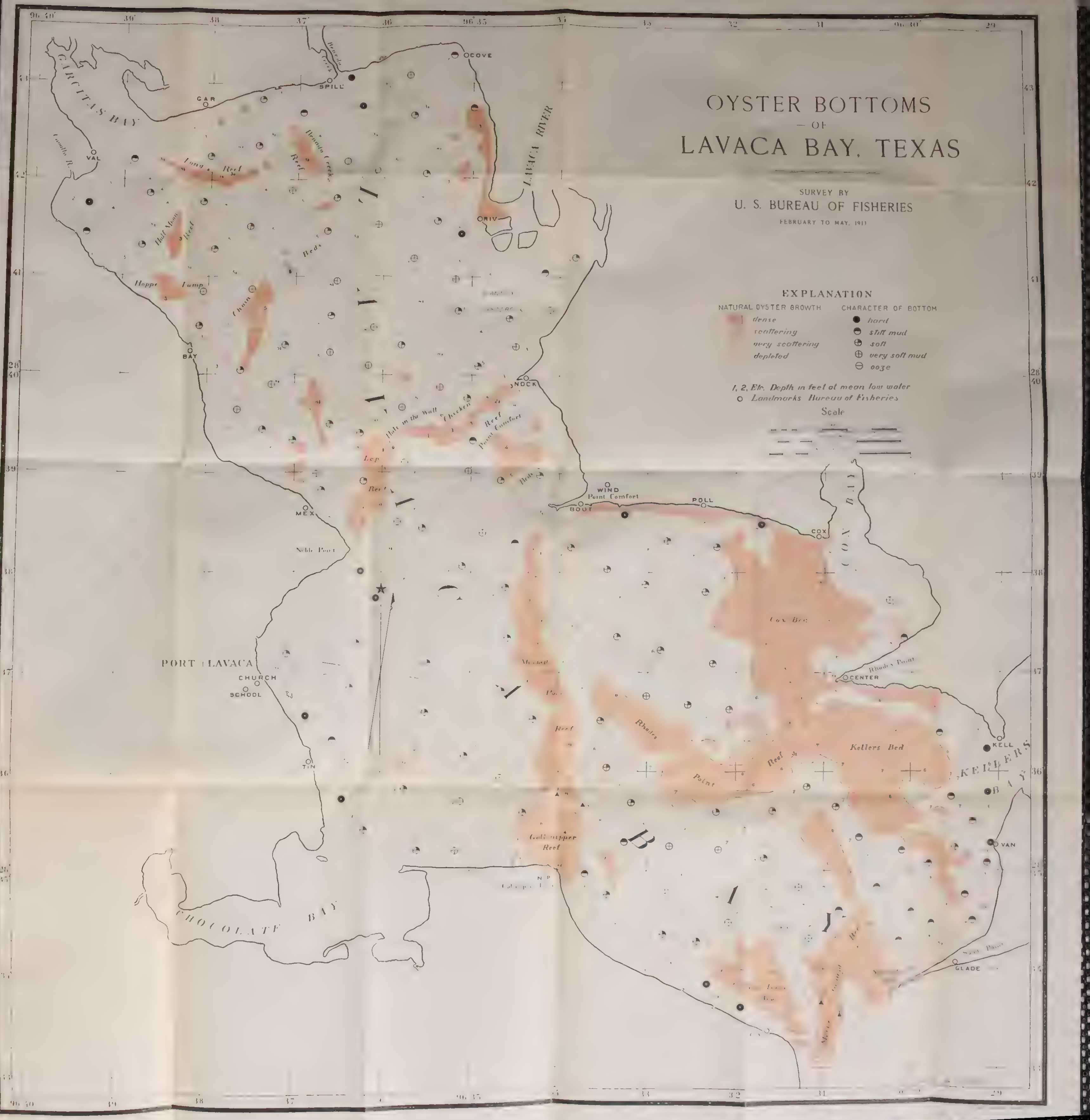
OYSTER FROM CHAIN BEDS.

(Natural size.)



"SNAPPER" FROM LAP REEF.

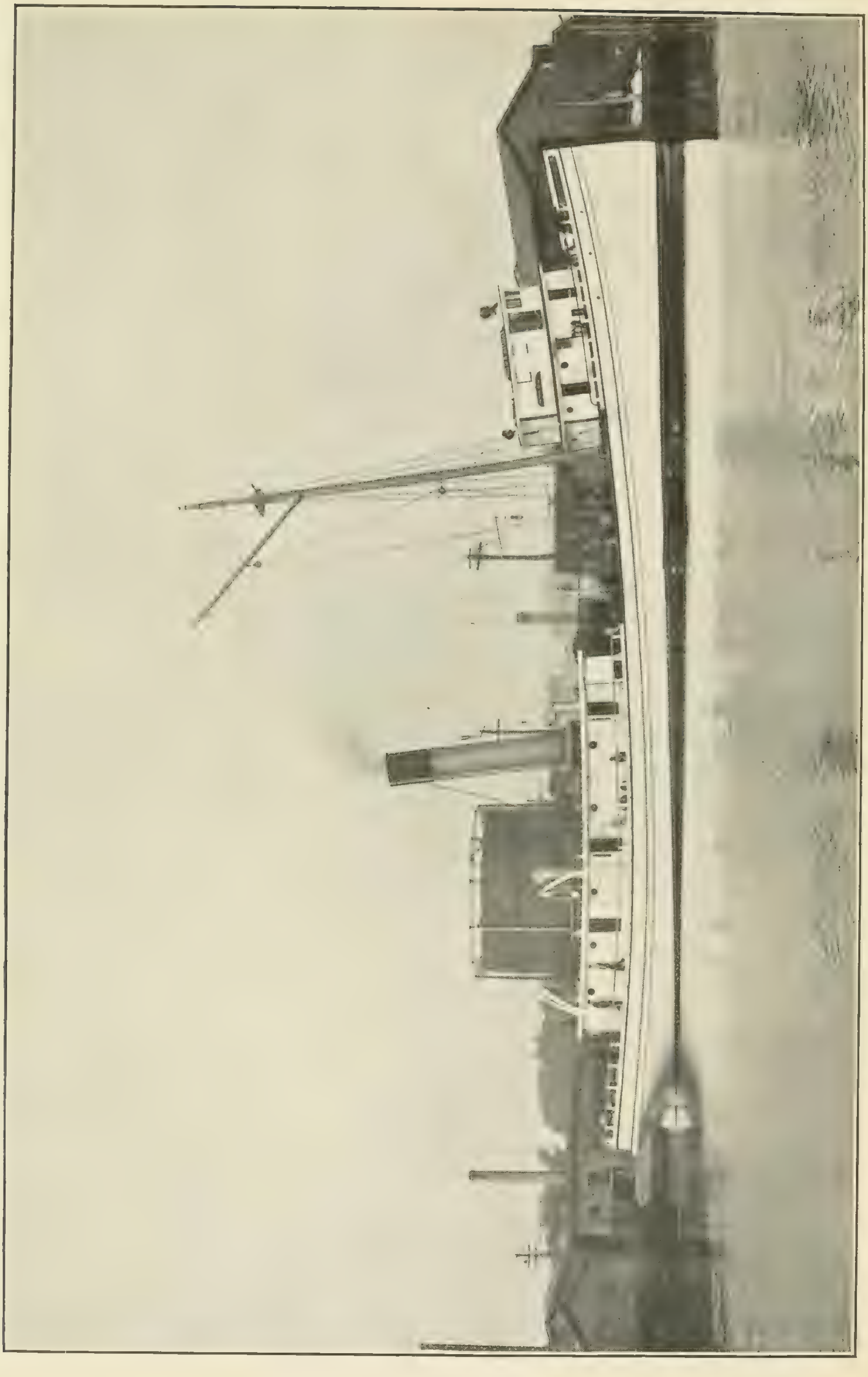
(Natural size.)



OYSTER BOTTOMS
— OF
LAVACA BAY, TEXAS

SURVEY BY
U. S. BUREAU OF FISHERIES
FEBRUARY TO MAY, 1911

PLATE I.



STEAMER USED IN MENHADEN FISHERY.

THE MENHADEN INDUSTRY OF THE ATLANTIC COAST

By Rob Leon Greer

Appendix III to the Report of the U. S. Commissioner
of Fisheries for 1914

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THE MENHADEN INDUSTRY OF THE ATLANTIC COAST.

By ROB LEON GREER.

HISTORY AND EXTENT OF THE MENHADEN FISHERY.

The taking of menhaden for fertilizing purposes dates back to the early settlers who first placed them on their ground as whole fish; later, when the value of the oil was discovered, it was extracted by placing the fish in casks, covering them with water, and compressing with weighted boards. In this process, the fish soon became putrefied, the oil cells disintegrated, and the oil floated to the surface and was skimmed off from time to time. The first process of cooking was by the use of kettles in which the fish were boiled; the mass was then placed in casks and treated as above, with the result that much more oil was secured than before. The residue was then used as fertilizer.

The next advancement in the industry, which had been of little importance up to this time, was when steam cooking superseded the use of the kettles. The first steam factory was established in Rhode Island; others were subsequently erected on Shelter Island, N. Y., and in Connecticut and Maine. In December, 1866, the steamer *Ranger*, hailing from Greenport, N. Y., was sent to Virginia. She was equipped with the necessary apparatus for cooking the fish and extracting the oil on board, and so far as is known was the first floating factory. The fish were caught in purse seines operated from sailing vessels. She remained there only about 11 days during that year, but returned each of the two succeeding years. The first factories built in Virginia were established by northern companies in 1868; one was on Tanners Creek and another on Back River, though it was not until the following year that the work was taken up at Reedville, in Northumberland County, which place is now the most important fish-scrap center on the coast. The first menhaden factory in North Carolina was built on Harkers Island, in Core Sound, in 1865.

During the year 1912 there were 48 menhaden factories on the Atlantic coast, having a total valuation of $3,625,983, distributed by States as follows: Maine, 1; Connecticut, 2; New York, 5, including one floating factory; New Jersey, 5; Delaware, 2; Maryland, 1; Virginia, 19; North Carolina, 12; and Florida, 1. The vessels engaged in fishing for menhaden for these factories numbered 147, valued at

$3,456,792; the total net tonnage was 13,566. Of these 118 were steamers, valued at $3,303,292, and 29 were gasoline boats, valued at $153,500. Two hundred and seventy-four purse seines, valued at $271,000, and 386 seine and striker boats, valued at $83,135, were used. The number of persons employed in and about the factories was 2,159, their salaries and wages for the year amounting to $560,834; the number of fishermen engaged was 3,735, and their wages amounted to $1,018,150. The total number of menhaden utilized was 1,061,843,750, which yielded 6,651,203 gallons of oil, valued at $1,551,990, and 88,520 tons of scrap, valued at $2,138,165.

The degree of success attending this important fishery, which is prosecuted annually, varies greatly; the number caught and also the fatness of the fish is much greater some years than others; consequently, similar catches do not always yield similar quantities of oil. The catch of 1911 was probably one of the largest ever known and the large dividends paid that year gave the industry such an impetus that four new factories were established during that season and eight in 1912; in addition to these, four new ones were being operated in 1913 and two others were under construction. It may be incidentally stated that the fishing during the season of 1913 was practically a failure, at least two of the factories having been forced into receivers' hands. Despite this increase in the number of factories during the last three years, there are not now as many as have been operated during some previous years. But when it is considered that the present-day plants are so much larger and the modern equipment so greatly facilitates the handling of the fish, the possibilities are probably greater to-day than ever before.

FACTORIES.

A menhaden factory should be within a few hours' run of the fishing grounds and also on deep water, to avoid the necessity of building a long wharf to reach from the plant to a channel of sufficient depth to float the steamers, many of which have considerable draft. This, however, is not always possible; one factory has a wharf 1,100 feet long, and at another place the entire plant is built over the water. The elevator or other device for removing the fish from the hold of the steamer and the device for measuring the fish are always placed on the outer end of the wharf; the "raw box" may be either on the wharf immediately back of the elevator or on the other end near the factory.

The chief desire in drawing plans for the building is to have the machinery so arranged as to facilitate the handling of the fish, and for this reason the most of the buildings have two stories. The cooker is generally on the ground floor quite close to the raw box; in some plants it is not in the building but is placed on the outside with only a roof to protect it from the weather. The presses are generally placed on the second floor and the oil tanks are at a lower level, so that the oil and water flowing from the presses reach them without the use of a pump; these tanks are frequently found on the outside of the building with no covering, though in most of the northern plants they are under roof. The drier is on the ground floor, either in the building or under a shed. The equipment of the average factory, therefore, consists of an elevator, measuring device, raw box, cooker, press, drier, and oil tanks, with the necessary bucket, chain, or screw conveyors for moving the material from one part of the plant to another.

The power of the boilers and engines naturally depends upon the equipment of the factory; two 125-horsepower boilers, costing about $1,500 each, are sufficient for a plant having one cooker, two presses, and one drier; the cost of the entire equipment of such a plant is approximately $24,000 and the capacity is about 600,000 fish in a day of 12 hours. The largest factory on the coast has a daily capacity of about two and a half millions of fish and employs upward of 200 men.

In addition to the main factory there are several other buildings set apart; these include the office, the "scrap room," in which the scrap is bagged and stored until such time as it is to be shipped, the mess house, and the sleeping quarters for the men. Some of the factories built during recent years have cement floors, this material having found favor among the operators because it is more durable and also more easily kept clean than wood; and many of them are lighted by electricity generated on the premises, one having installed, in addition to a plant for lighting, electric motors for operating the machinery.

VESSELS.

In the early days of menhaden fishing the vessels were all schooners and sloops; steamers were introduced some time during the seventies, but the sailboats were also employed for a number of years after the advent of the steamers. The present-day steamers are built somewhat on the tug model, with an extra high bow, which serves a twofold purpose, that of rendering them more seaworthy and giving the pilot the advantage of a much greater scope of the sea. The quarters are forward and the engine, boilers, and bunkers toward the stern, leaving the hold in the middle of the boat where the deck is low so as to facilitate the transfer of the fish from the net. The auxiliary schooners, which are all owned in North Carolina, with the exception of two in New Jersey and one in Maryland, have practically the same arrangement. While the total number of vessels now employed in this industry is not as great as some previous reports have shown, the fact that they are now all propelled by steam or gasoline gives them a great advantage over the sailing craft formerly used. They can go farther in search of the fish and can return to the factory very much more quickly when a load is secured and are not so often delayed by inclement weather. Many of the steamers now in use are lighted by electricity and also have searchlights and are modern in every detail. The largest one in use during 1912 has a capacity of over a million fish, but a larger one was built in 1913 at a cost of $100,000 and with a capacity of at least one and one-half million fish. The largest gasoline boat fishing for menhaden has a capacity of 400,000 fish and is owned in New Jersey. Twenty-seven new steamers were built in 1911 and 1912 and several new ones were in course of construction in 1913. It is seen from the above figures that the Chesapeake region leads in both the number of factories and the number of steamers in use.

PURSE AND STRIKER BOATS.

The purse or seine boats must necessarily be built very strong to withstand the great strain to which they are subjected; they frequently put out in rough seas, and there is also considerable strain when handling the seine. Cedar is mostly used in their construction, for both the planking and the ceiling. In the stern a platform measuring about 3 feet fore and aft is built 10 inches below the gunwale; upon this the captain stands to direct the movements of the boat; a similar platform is in the bow and upon this stands the man who handles the cork line when pursing the net. There is also a platform or floor in the bottom of the boat. There are four thwarts, three of which are forward and the fourth immediately forward of the after platform referred to above; the intervening space is for stowing the seine. The stern of these boats is built about 2 inches higher than the bow so that they may be properly balanced when the seine, most of the weight of which is toward the stern, is aboard. The dimensions are as follows: Length, 28 to 33 feet, though the preferable length is 32 feet; beam, 6 to 7 feet; depth, 2 feet to 2 feet 10 inches amidships. The cost ranges from $275 to $400.

The striker boats are simply small rowboats, carvel built, with a sharp bow and square stern. They are about 12 feet long, 4½ feet beam, and 1 foot 9 inches deep amidships. The striker usually stands when rowing, on a small platform in the bottom of the boat. The cost of these boats is $100 to $120.

FISHING APPARATUS.

By far the greater portion of menhaden handled at the factories is caught in purse seines, about 98.7 per cent of the entire catch of the year 1912 being taken with that form of apparatus; the greater part of the rest was taken in pound nets fished in Raritan Bay, N. J., and converted into scrap at a factory located at Port Monmouth, in the same State. Some were also caught in pound nets in New York and Virginia. Only one factory, one of the smaller ones in North Carolina and probably the smallest on the entire coast, depends entirely on the shore fisheries for its supply of fish; their apparatus consists of gill nets 175 to 200 yards long, 5 feet deep, with 1½-inch mesh. They are fished from small sailboats having a capacity of about 7,000 fish each and carrying one man each.

The purse seines in general use are about 135 to 200 fathoms long, 9 to 10 fathoms deep, with 1¾-inch mesh; the size of the twine used for knitting them varies in the different parts according to the tension to be applied, the heaviest being in that part called the "bunt" for the reason that it bears practically all the weight of the fish when the seine is pursed; this consists of a square of 400 to 500 meshes in the center of the net and it is made of no. 15 and no. 18 cotton twine. The other parts of the net are made of no. 20–9 and no. 20–12 twine. The cork and ring lines at the top and bottom, respectively, are both no. 12 thread, right; there are two additional lines, no. 9 thread, left, to which the seine is hung. These run parallel to the cork and ring lines the entire length of the net and are lashed to these lines at regular intervals.

The four lines indicated above are all manila rope. The purse line is no. 36 thread, Russian hemp, about 150 fathoms long. The brass rings through which the purse line passes are 4 inches diameter, weigh 1½ pounds, and cost 50 cents each; these are suspended from the lower line on beckets or loops each 6 to 12 inches long and 3½ to 5 fathoms apart. The final rings are placed about 10 fathoms from the ends of the net. In order that the center of the net may be located, the "ring" placed at that point is shaped more like a stirrup, so that it may easily be distinguished from the others. The corks vary in size from 3 to 4½ inches in diameter, the larger ones being placed at and near the center of the seine in bunches of three or four quite close together, so arranged because the greatest weight is on that part when the net is pursed; the smaller corks are toward the ends of the net and placed farther apart than the others. From 2,200 to 3,200 corks, costing from $30 to $45 per thousand, are used on a purse seine. The beckets, to which the "hank" lines on the gunwale of the steamer are made fast for the purpose of holding the net close to the vessel when the fish are being transferred, are arranged along the top of the net at the center of the bunt at intervals of about 2 feet; there are 20 to 24 beckets, each about 1 foot long. To prevent rotting, the top and bottom lines are tarred, but the purse line is not so treated, because it would become too stiff and consequently difficult to handle; for the same reason the net is tarred but once, and that when new.

The subsequent treatment for its preservation consists of a pickling process as follows: After the day's fishing is done, about 4 bushels of coarse salt are sprinkled over each "arm" of the seine as it lies in the seine boats; 12 to 15 buckets of sea water are then poured over each arm, and as that collects in the bottom of the boats it is pumped into buckets and poured over the twine—the same water, or brine, as it has now become, being used over and over until 75 to 100 bucketfuls have been poured; this is repeated in the morning and perhaps several times during the day, if the net has not been put overboard and so much sea water taken aboard with it that the "pickle" is too much diluted to be of further service.

When the twine is very slimy, as is frequently the case after a haul has been made, it is washed by a stream of water from the fire hose on the steamer. The cost of a seine completely rigged for fishing is about $1,000; and they are seldom used more than one season. The "long tom" is simply a large piece of lead with flat bottom and rounded top, weighing about 300 pounds, which is placed upon the purse line by the use of two snatch blocks which are fixed in its sides and dropped overboard after the net has all been paid out, to hold the ends of the net before it has been pursed. An eyebolt is fixed in the top of the tom for the attachment of a line used for the purpose of hauling the weight back into the boat. The cost of a tom is about $30.

SEASON AND FISHING GROUNDS.

As the menhaden is a migratory fish, the season naturally differs on various parts of the coast; the location of the factories governs to some extent the range covered by the fishing steamers, it being desirable to remain close enough to their respective factories to run in and discharge their fish before they putrefy; but the steamers sometimes get so far away that they find it advantageous to sell their catch to some other factory. As the fish appear to seek the coast the steamers seldom go more than 10 or 15 miles out to sea. While menhaden occur in Florida throughout the year, the bulk of the catch is taken from April 1 to November 1. The small catch in winter, according to the fishermen, is owing to the fact that the fish seldom appear at the surface of the water during that season. The steamers fishing in Florida seldom go farther than 10 or 15 miles north or south from the mouth of the St. Johns River. Some fishing is also done in that river and Nassau Sound, but the catch in those waters is inconsiderable. The spring and fall "runs" determine the season for the North Carolina fishermen; the northward movement generally ends about June 15 to 20 and very little fishing is done from that time until the schools reappear southbound during late September or early October. The bulk of the catch taken by the boats from this State is from outside waters, generally from Cape

Fear to Ocracoke Inlet; some are also caught in Core Sound. The steamers hailing from Chesapeake Bay region generally begin operations the first or second week in May; the work is chiefly at sea from the beginning of the season until the first of July, and during that month and throughout August and September practically all the fishing is done in the bay, from which it is estimated that fully 75 per cent of the entire catch is taken. From September until the close of the season, which is usually November 10 to 15, the vessels go outside again. The range covered by the Virginia vessels is from Cape Hatteras on the south to Sandy Hook on the north. The season and fishing grounds for the Delaware and New Jersey steamers is practically the same as that given for those from Virginia, except that they are excluded from Chesapeake Bay. The New York and Connecticut menhaden fishermen have a shorter season and their range differs in that they seldom go farther south than the Virginia capes; their northern limit is rarely extended beyond Boston Bay, though the northern limit of migration of the menhaden is the Bay of Fundy, but they are not found in sufficient number to warrant going farther than is here stated. Schools of menhaden were reported in Casco Bay a few years ago but very few were caught. Some are also caught in Long Island Sound, Vineyard Sound, and Gardiners Bay.

FISHING METHODS.

The time of the steamer's departure from the factory depends chiefly upon the running distance to the fishing grounds; they are usually in readiness and off by 4 o'clock in the morning, though they frequently go earlier. It is the general belief among the fishermen that the early morning is the best time for fishing. Very little attention need be given to the tides when fishing offshore, but in inside waters the tide is often so strong as to render the handling of the seine difficult, and better results are obtained when working on slack water. As soon as the fishing grounds are reached the captain and the mate repair to the "crow's nest" at the mast, from which point of vantage they survey the surrounding waters to locate the fish, an experienced eye readily distinguishing the reddish hue which indicates their presence. When a school is sighted, those aloft rapidly descend and prepare to "lower away" the seine boats; the striker drops off in advance and rows toward the fish to keep trace of them and indicate to the captain, by signals made with an oar, the direction in which they are moving. The captain is in charge of one of the boats and the mate directs the movements of the other.

At the opportune time the seine, one-half of which is stowed in each boat, is thrown out by the "seine setters," the oarsmen rapidly rowing in a circular direction in order that they may surround the fish; the striker in the meantime has taken a position on the opposite side of the school and by splashing the water with an oar endeavors to prevent their escape. When the two boats meet a large hook attached to a line made fast to the bow of the mate's boat is caught under the center thwart of the captain's boat to prevent them drifting apart. The tom is then dropped overboard and the men begin hauling both ends of the purse line through two snatch blocks which are attached to an upright iron support about 18 inches high called the "crane" and which is fitted in the port gunwale of the captain's boat about 10 feet from the bow; the line is carried directly across to two snatch blocks hung to the starboard gunwale, the one end continuing on toward the stern and through another block attached to the same gunwale and the other end going to the men in the mate's boat. The ends of the net are hauled into the boats as it is being pursed and arranged in an orderly manner so as to be in readiness for the next set; when the rings are all in, the tom line is placed in one of the blocks on the crane and the tom hauled aboard. The hook referred to above as holding the boats together is then released and the bows are lashed together.

It is sometimes necessary for the striker to tend the cork line to guard against its being submerged when the fish are all in the bunt of the net. When all is in readiness the captain signals to the pilot to bring the steamer alongside for the purpose of transferring the fish to the vessel hold. The hanks, which hang along the gunwale, are made fast to the beckets on the bunt of the seine so as to hold it close to the vessel, and the bailing begins. The bailing net is simply a bag 4 feet deep, made of cotton twine and hung to a circular frame about 4 feet in diameter, made of 1-inch iron; it has a wooden handle approximately 12 feet long. The net is suspended from a boom hung to the mast directly over the hold and so arranged as to swing back and forth; it is raised by a small engine placed on the deck a little aft of amidships. The fish are dumped by means of a line attached to the bottom of the net and passing through a block hung to the boom above. Two other lines attached to the rim of the net, one held by a man standing on the deck of the steamer and the other by a man in one of the seine boats, are designed to assist in guiding the net as it is raised and lowered. The handle is controlled by a man standing on the deck along the gunwale.

It is possible to handle fish at the rate of a half million an hour with this net. When a set is made and the seine found to be empty when pursed it is said to be a "stab"; when they begin paying out the net and the fish are seen to disappear before it is all out, it is a "pullback." The usual time required for making a set and pursing the seine is 30 to 40 minutes.

No fishing is done at night; the steamers always make some harbor, preferably their home port, but if too far from that they run in to some place more convenient.

CAPTURE OF EDIBLE FISH.

Much has been said during past years regarding the use of edible fish taken in the menhaden nets for the manufacture of fish scrap. That the number of such fish actually taken in purse seines with the menhaden is, however, too inconsiderable for discussion seems to be conclusively shown. While the menhaden are being taken aboard the steamer the cook usually stands over the hold with a long pole, in the end of which is a hook, for the purpose of removing the edible fish which are wanted for the ship's mess; his keen eye misses few mackerel, trout, etc., but even with this vigilance he does not secure enough to provide food for the crew. The writer spent a day on one of the largest steamers owned in Virginia, and in a total catch of 240,000 menhaden for the day there were only 8 mackerel and 10 bluefish. At times, however, the vessels may strike a school of some edible species and carry them to market; it is probably safe to say that such fish are never converted into scrap. The Virginia captains have explicit instructions to avoid taking food fish, and an instance is on record of one of the most proficient captains in the business being dismissed for disobeying the order.

Considerable quantities of alewives, caught in pound nets fished in Chesapeake Bay and tributaries, are sold to the menhaden factories located at various points on the bay; the nets are fished primarily for the purpose of supplying the alewife packing houses, but the catch is frequently greater than the capacity of the houses and the fishermen appeal to the menhaden factories to send their steamers to take the surplus fish off their hands. This custom prevails especially about the head of the bay in Maryland waters, where the catch of the pound nets includes not only alewives but many perch which are too small to be marketed.

The argument offered in defense of this is that inasmuch as the fish are trapped and die in the nets it is better to sell them to be converted into fertilizer, and thus serve the farmer and consumers generally, than to pollute the water by throwing them overboard. Despite the claim by the factory owners who send steamers after these fish that they do so at a loss and would rather not be troubled with them, and that they would welcome legislation prohibiting handling them, there seems to be a spirit of jealousy among them, and when the first steamer goes others usually follow. An additional and very strong argument against this practice is the storm of protest and condemnation brought upon the menhaden factories by various persons, who gain an undue impression of the number of edible fish that are made into scrap.

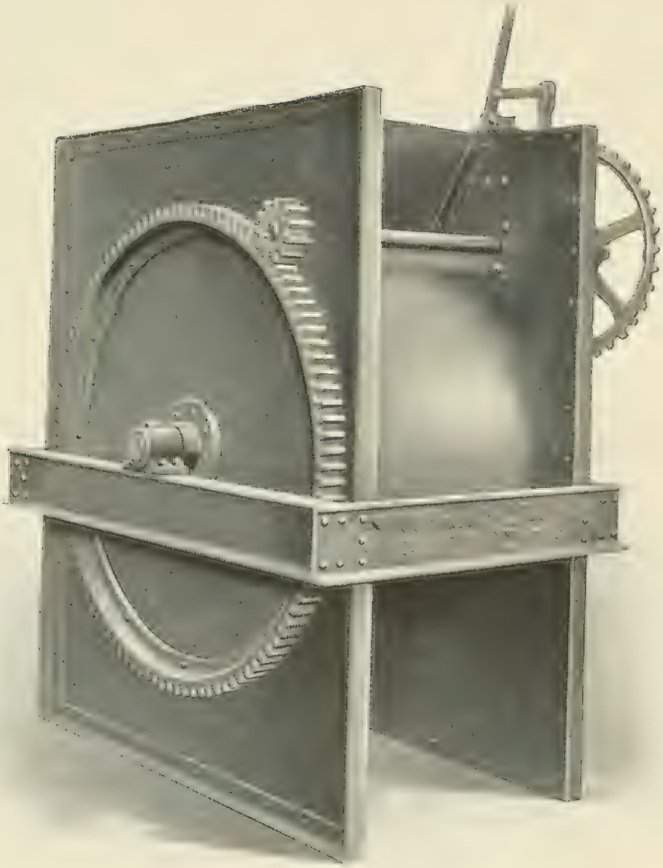
Large quantities of alewife cuttings from the packing houses are utilized at the menhaden factories, but it was impossible to secure definite data regarding the amount, as it is not kept separate from the alewives and perch handled; neither is the oil and scrap thus derived kept separate from that made from the menhaden. It has been stated, however, that the major portion of what is shown in the bulletin as "scrap fish and alewife cuttings" was the latter. Some sea robins, swellfish, and skates are taken in pound nets fished near Promised Land, N. Y., and sold to menhaden factories at that place; they are called "evilfish" and are not regarded as being edible, though the fishermen sometimes "saddle" the skates by removing the pectoral fins, which are sent to Fulton Market, New York, where they are sold chiefly to the foreign trade. These fish are not especially desired at the factories, for several reasons; they are not caught in sufficient quantities to render handling them remunerative; they produce very little oil, and they do not pass freely through the modern machinery because of the bone in the sea robins and the cartilaginous character of the skates, which when cooked become so viscous that they stick in the presses.

No special effort is made by the fishermen of the Atlantic coast to catch dogfish, but many are taken on the trawl lines and thrown overboard; it has been suggested that it might be profitable for the menhaden factories to work them up into scrap, but considering the number of fish required for making a ton of scrap and the price received for the latter it is doubtful if the factories could afford to pay the fishermen enough to render it remunerative.

Very little is known by the menhaden factory operators about handling dogfish and other sharks and the machinery as now used is not adapted to this purpose. Some sharks are caught in the purse seines fished in Florida waters, chiefly during the months of May and June. They are not cooked nor cut into small pieces, but the whole shark is thrown on the acidulated scrap heap, where the action of the acid will in time disintegrate it.

UNLOADING AND WEIGHING OR MEASURING.

In former years the fish were all removed from the vessel hold by means of tubs each having a capacity of 500 fish. While this method is now regarded as antiquated, it is yet in use in a few of the smaller factories. The tubs are filled by hand and raised by means of a block and tackle and the fish are dumped into bins or small cars which convey them to the factory. All the larger and best-equipped factories now use a bucket elevator for removing the fish from the vessel. This is very similar to that in use in grain elevators and has proved very satisfactory in fish factories. The elevator is so arranged that it may be lowered into the hold of the vessel, where the fish are fed into it by the "fish gang," consisting of four or more men, and carried up to the weighing or measuring device. One of these elevators can handle 1,000 barrels of fish in an hour with an engine of 20 to 25 horsepower.



FISH MEASURING MACHINE.

The measuring device found in most of the plants is shaped like a cylinder and mounted so as to revolve on an axis. It is divided into four segments, each of which has a space of 22,000 cubic inches, and will accommodate a bulk of fish which is taken arbitrarily as 1,000 in number; this is based on the standard measurement of 22 cubic inches for one, or 22,000 cubic inches for 1,000 menhaden. The number of fish to each 22,000 cubic inches naturally varies with their size. When one segment is filled the cylinder revolves and dumps the fish and the next segment is brought into place to be filled.

Another form consists of two weighing hoppers, with a dial indicator of 1 ton capacity. When one hopper has received the required weight of fish they are diverted into the other by means of an apron-like device which is shifted by a lever worked by the man in charge of the elevator house. Two of the factories have recently installed conveying weighers which are similar in construction to the ordinary platform scales; the track on which the belt which carries the fish moves is suspended from the weighing levers, which with the integrator are inclosed in a sheet-iron case. The fish are dumped from the measuring device into a conveyor, usually of the bucket type, which carries them either directly to the cooker or to the "raw box" or bin in which they are stored until such time as they can be used. These bins are all about the same depth, 10 to 12 feet, but vary in length and breadth according to the capacity of the plant and the number of steamers employed. The largest one in use is about 25 feet wide and 225 feet long. The floor slants toward the middle, where a conveyor moves in a close box with a covering which may be removed in sections when the fish are to be taken from the bin and conveyed to the cooker.

COOKING.

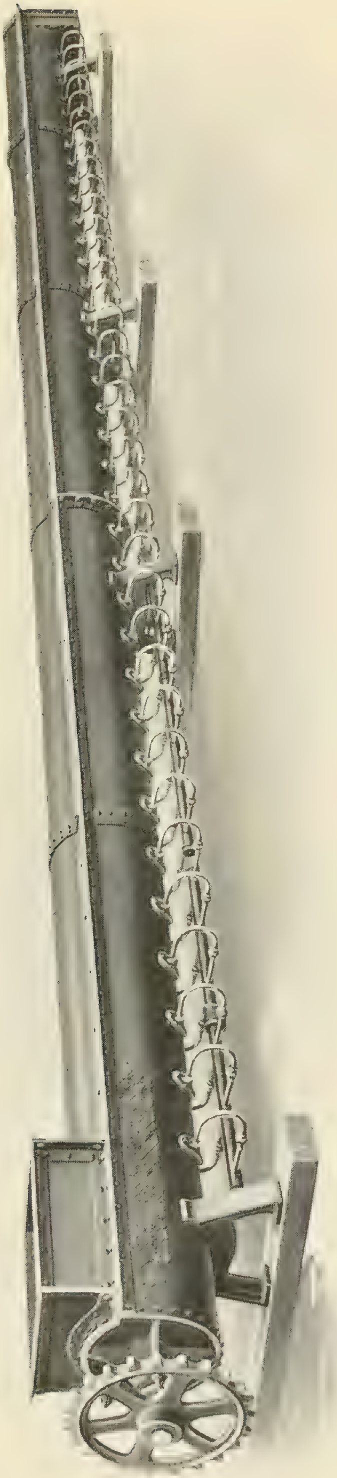
The fish are generally cooked at night as soon as the steamers reach port and discharge their catch. It is desirable to cook them as soon after they are taken from the water as possible, because they putrefy quite rapidly and are so much more difficult to handle in that condition. Cooking has the effect of breaking up the fat cells or sacs and permitting a ready liberation of the oil. The continuous steam cookers have gradually displaced the old-style cooking vats from year to year until the latter have been almost eliminated—North Carolina being the only place where they are now in use—and it is probable that they will be supplanted there by the modern apparatus if the business is sufficiently lucrative to justify the expenditure. The old style consists of the simple process of cooking the fish in vats or tanks having false bottoms beneath which are placed perforated steam pipes; the vats contain a sufficient quantity of water to cover the fish. The water is heated before the fish are put into it, the usual time for cooking the fish in these tanks being about 20 minutes. In one of the factories of North Carolina the antiquated method of making a fire under the vat still prevails; the vats are made of wood, with iron bottoms.

The modern cookers are of the direct-steam type and operated continuously. The fish are fed through a hopper-like entrance into a steel shell or cylinder of varying lengths and diameters. A cooker finding much favor among the operators of menhaden factories is 40 feet long and 2 feet in diameter; a shaft, the diameter of which varies with that of the cylinder from 3 inches to 4½ inches, passes through the center from end to end and is provided with flights so arranged as to act as a conveyor and keep the fish moving toward the discharge end. Thirty-six iron feed pipes, each three-eighths of an inch in diameter, enter the shell on each side quite near the bottom at intervals of 1 foot; this arrangement insures a complete circulation of the steam through the fish as they are passed through the cylinder. Attached to the discharge end, a little lower than the main cylinder, and either at right angle or parallel to the same, is a smaller shell about 8 feet long and 1 foot in diameter, which is designed to prevent the steam from escaping. The mass of cooked fish drops into this after passing through the cooker and is carried through by a screw conveyor. This is probably the most effective form of this apparatus, as the steam is more thoroughly distributed by being introduced beneath. Other types in use differ chiefly in the manner of admitting the steam. In one form it is admitted through a hollow shaft 6 inches in diameter along which at intervals of 16 inches are arranged sets of radial pipes screwed into the shaft at equal intervals around its entire circumference. These are simply sections of 1-inch iron piping, each 8 inches long. They are closed at the end, but each has three perforations through which the steam escapes to the chamber. These also serve as flights to move the fish toward the discharge end of the cylinder. Another type used in a number of factories feeds the steam through perforations in the shaft, which is fitted with flights which are simply solid pieces of iron.

PRESSING.

While the old-style curbs and hydraulic presses have been displaced to a considerable extent by the modern screw presses, they are yet in use in a sufficient number of factories to justify some description of them; in some of the plants they have been retained after the installation of screw presses, to be used in case the latter should be disabled or in any other emergency that may arise. Many of the operators prefer them to the modern apparatus because the screw press gives such a great pressure that quantities of fleshy matter are forced out with the oil and water, with the result that the separation of these in the oil room is rendered more difficult and the amount of scrap made is

PLATE III.



CONTINUOUS STEAM COOKER.

lessened. This is especially true when the fish have become decomposed. It has been claimed that the use of the curbs yields fully 10 tons more of scrap from a million of fish than the screw presses. The mass of fish drops from the cooker to a screw conveyor, which feeds it to a bucket conveyor to be carried to the second floor, where it passes to a second screw conveyor extending through the center of the room over the draining tanks; the box containing this conveyor is provided with troughs through which the mass drops to the tanks, where it remains over night, during which time a considerable quantity of the oil and water drains off and is carried through troughs to the oil tanks.

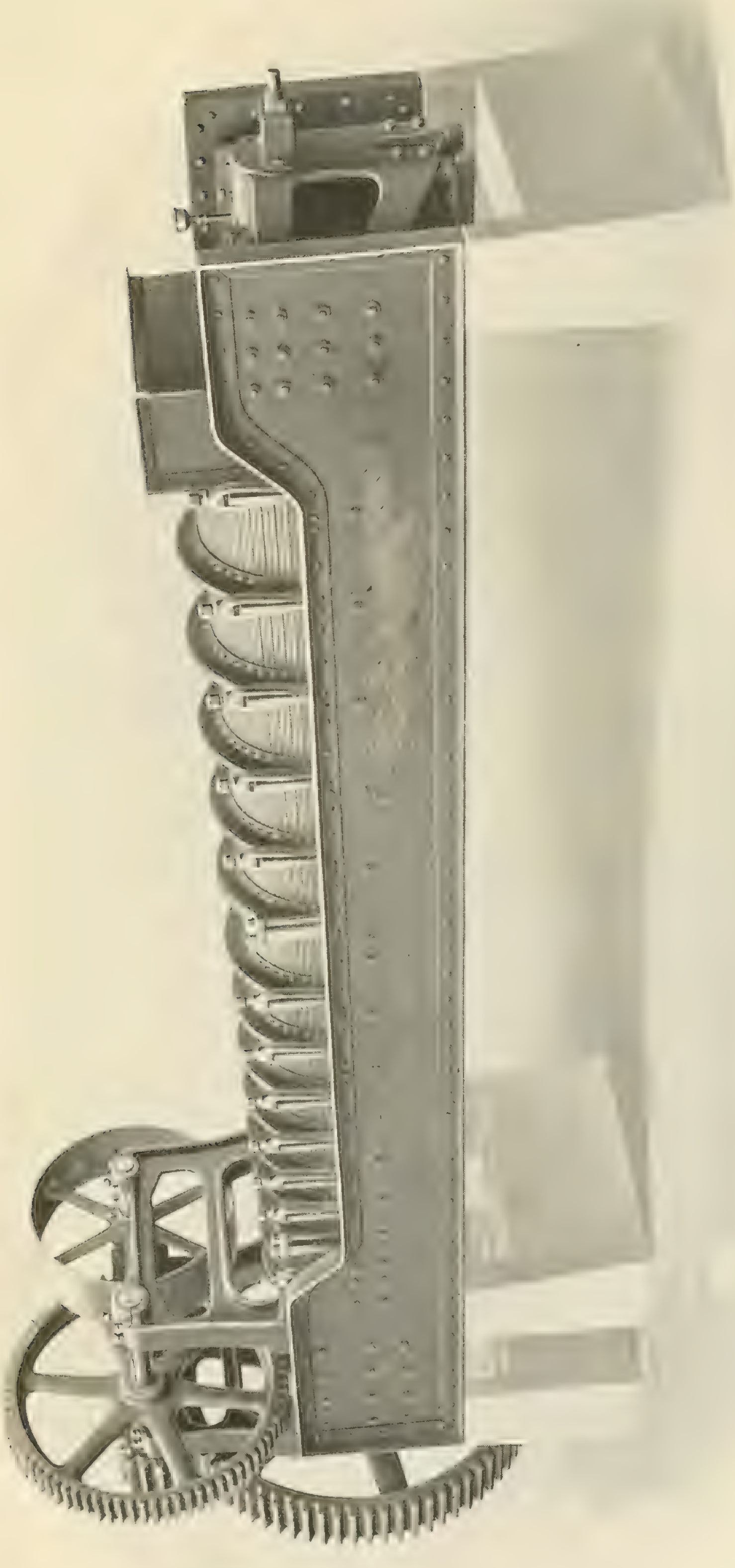
In the morning the men get into the draining tanks and throw the cooked mass over into the curbs, using a large fork, the tines of which are close enough to retain the solid matter and yet permit a portion of the oil and water to run through. The most common form of curb now in use is a cylindrical tub provided with four wheels, about 20 inches in diameter, so as to run on a tramway which is built alongside the draining tanks; the tub is 40 inches deep, 35 inches diameter at the top, and slightly wider at the bottom; it is constructed of 100 beveled iron staves, three-eighths inch thick, seven-eighths inch wide on the outer side, and slightly wider on the inner side, with sufficient space left between the staves to permit the escape of the oil and water. The staves are securely riveted to heavy iron bands which encircle them, and every tenth stave widens from the center toward the lower end, thus giving the curb an increased width at the bottom so that the hard cake remaining after the pressure is relaxed can be more easily expelled. A hollow core, about 12 inches in diameter and 33 inches long, fits in the center of the curb; this is made of staves similar to those already described and has a rounded top of iron in the center of which is an eyebolt; a hook which may be attached to a chain working in a pulley suspended from above, or to a piece of wood which is laid across the top of the curb, is caught in this eyebolt when the pressed mass is released, to prevent the core dropping. The bottom of the curb is simply a piece of heavy sheet iron attached to the lower band of the curb by means of a loose-pin hinge; the opposite side of the bottom is held in place by a lathe which is opened by a lever when the curb is to be emptied, permitting the bottom to swing. The curb is attached, by means of stays on one of the iron bands referred to above, to a square frame of ½ inch by 2½ inch iron, which is built about it; this frame also serves as the axles, and the spindles on which the wheels revolve are bolted to it at the corners.

When the curb is filled it is run on the railway to a point under a stationary head which fits closely inside the curb; as the latter is slowly raised by a powerful hydraulic press the fish are pressed against the head and the remaining oil and water forced out between the staves. The oil and water are prevented from spattering over the workmen when the pressure is applied by shields of metal or other material built around the curb, and as it is forced out it runs through troughs to the oil room. When the pressure is relaxed, the curb slowly descends to its former position on the rails and is pushed from beneath the head and the bottom released by the lever referred to above. The core is held, as has been stated above, and the pressed mass of fish drops through an opening in the floor to the room below. Another form of curb differing slightly in construction from the one just described is in use in some of the plants. The iron bands surrounding it are fitted with latches, which open to release the hard cake remaining after the pressing, and the diameter of the cylinder is the same from top to bottom.

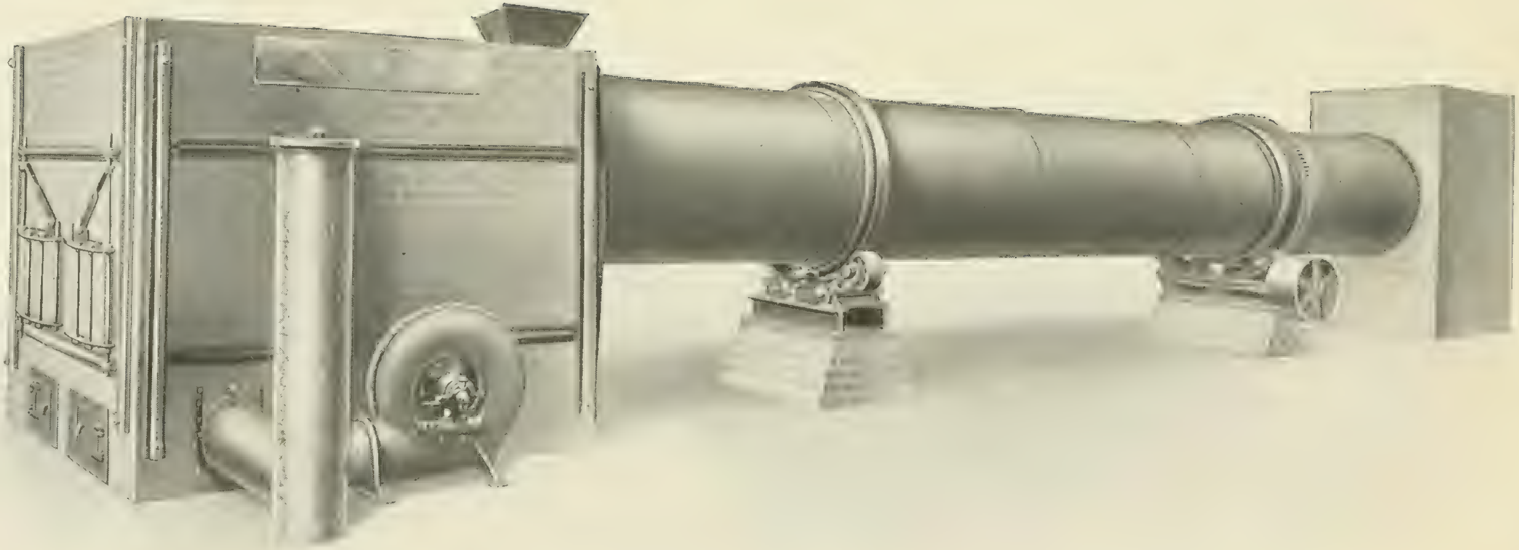
SCREW PRESS.

When the screw press is used the digested fish are conveyed directly from the cooker to the press, thus eliminating the draining tanks referred to as being used in connection with the curbs and effecting a saving in time and labor. The modern screw press consists of a horizontal tapered screw built up on a hollow shaft fitting closely and rotating in a similarly tapered steel-slatted curb with a hopper-shaped entrance 15 by 29 inches in size, into which the fish are fed from the conveyor. A section of the top of the curb may be removed, should the shaft or screw require repairing or cleaning. The pressure is caused by a gradual decrease in the size of the screw and curb, and the material must move toward the small end of the press as the screw turns; it can not turn with the screw nor slip on the curb. The hollow shaft is provided with perforations through which steam may be introduced directly into the material while it is being pressed; this is a decided advantage, in that it keeps the material hot and soft, a condition which permits a more thorough separation of the liquid from the solid matter. The drainage is both internal and external, the drainage space between the slats of the curb being supplemented by the drainage holes in the shaft.

One form of screw press is 18 feet long, or 23 feet including frame and gearing, has a capacity of 80,000 to 100,000 fish per hour, and costs $5,000. Another is 12 feet long, or 17 feet including frame and gearing, with a capacity of about 40,000 fish per hour, and costs $3,500. The larger press requires a 50-horsepower engine, and the smaller one may be operated with an engine of 35 horsepower. Another press very similar to the above is fitted with a cone capable of longitudinal adjustment on the hollow shaft and rotating with the same. The opening through which the pressed fish are discharged



CONTINUOUS SCREW PRESS.



DIRECT HEAT ROTARY DRIER.

is controlled by this cone and the pressure applied to the material while in the press is thus regulated. The oil and water collect beneath the press on the floor, which is made of concrete in many of the factories, and runs through troughs or pipes to the oil tanks for further treatment. According to the information available, there are 4 pounds of oil, 46 pounds of water, and 50 pounds of scrap in 100 pounds of the material as it leaves the press.

DRYING.

Under the old method of drying, the scrap is spread on a platform made of closely fitting boards or concrete, where it is exposed to the sun and air, two or three days usually being sufficient time for this form of drying when the weather is favorable. The scrap is turned over or stirred frequently so that it may all become thoroughly dried; the instrument used for this purpose is usually a wood-tooth harrow drawn by a horse. In the event of rain and at night, as protection from the dew, the scrap is collected into heaps and covered with tarpaulin.

The hot-air drier is now almost universally used in menhaden factories. At some few points, because of the strenuous protest of summer residents against the disagreeable odor emitted by the hot-air drier, the scrap is treated with crude sulphuric acid and sold as "acidulated scrap"; or in some cases it is dried during the winter after the departure of the summer residents. The acid is usually applied as the scrap is being conveyed to the shed in which the acidulated scrap is stored; it may flow in a small stream from a lead-lined tank set near by, or may be poured from a dipper by a man standing near the conveyor box. The estimated quantity used is 1 to 1½ gallons to 500 pounds of scrap. The acid dissolves the bone and also preserves the scrap by preventing the development of flies and other insects.

The pressed fish remains on the floor of the room below the press-room, where it is deposited after leaving the presses, until the following morning, when it is shoveled to a conveyor, usually of the chain type with wood flights placed at intervals of about 2 feet, and carried to the hopper of the drier. The drier is generally set under a shed built apart from the main factory building as a precaution against setting fire to the building should the intense heat in the drier fire the scrap. The direct-heat rotary drier is a revolving cylindrical iron or steel shell of various sizes, through which hot furnace gases pass, generally under forced draft produced by a fan at the side of the furnace. The cylinder has 12 spiral flights or shelves, each 8 inches wide, attached to its inner surface and running the entire length; these add to the rigidity of the cylinder and also lift the scrap to the highest point of the rotation and shower it through the hot furnace gases. The wet scrap and the gases enter the cylinder at the same end, thus giving the wettest scrap the advantage of coming in contact with the hottest gases and materially economizing both fuel and time. The cylinder is encircled by two steel tires, which are securely fastened to it, each resting on a set of four steel rollers, which in turn rest on brick foundations.

The power for rotating the drier is imparted first to these rollers by means of a shaft and from them by friction to the tires, or by the use of a spur pinion meshing with a large spur-gear ring encircling the drier. The brick furnace, which is provided with an automatic stoker, consumes about 5 tons of coal a day; its size is 9 by 10 feet, and it is built about the front or feed end of the drier, which is set about 9 inches higher at this point than at the other end, so that the trend of the scrap will be toward the lower and discharge end, assisted, of course, by the forced draft which blows it through as the flights referred to above lift it as the cylinder revolves. The lower end enters a brick chimney-like chamber 8 feet wide by 12 feet long; this serves as an outlet for the hot air and the vapor and also as a settling chamber for the dust coming from the dried scrap. A drier, 5½ feet in diameter and 40 feet long, with a capacity of 600,000 fish per hour, costs $2,300; one 50 feet long, with a capacity of 80,000 fish per hour, costs $2,600, exclusive of the brickwork of the furnace and chimney, which costs about $350, and an engine of about 25 horsepower to run it. It is necessary to give close attention during the operation of the hot-air drier in order to guard against burning the scrap by having too much heat and also to keep heat enough to dry it thoroughly. It is sometimes necessary to run it through the second time if the first passage is too rapid. The scrap dried by this process is much darker in color than that dried on platforms, no doubt because it is somewhat scorched by the intense heat of the furnace.

The scrap drops from the drier into a screw conveyor, which passes through the wall of the chimney, and is taken up by a chain conveyor to be carried to the scrap room. The box in which this conveyor moves is usually placed close under the roof of the building and is provided with traps or slides which may be drawn and the scrap deposited in any part of the room desired. Twelve thousand to fifteen thousand fish will make 1 ton of scrap; the quantity made from one million fish varies from 75 to 85 tons.

Fish scrap is used almost entirely for fertilizing purposes; a negligible quantity may be used for chicken feed and as cattle food. The major portion is sold to the fertilizer mixing plants at various places, a large percentage being handled by the Baltimore dealers. Samples are sent to the prospective purchasers, who analyze it and fix the price according to the percentage of ammonia contained in it, which usually runs 10 to 12 units. Several of the menhaden factories have established their own fertilizer plants and market all of their fish scrap combined with other fertilizer materials under their private brand names. Acidulated scrap is generally shipped in bulk in vessels, but the dried scrap is usually handled in bags, which are furnished by the mixing plants to which it has been sold. The bags are mostly secondhand and of no particular size or quality. Some years ago farmers living in the vicinity of the fish factories frequently used the crude or green scrap for fertilizing their land, but that custom has been practically abandoned during recent years.

During the year 1912 there were manufactured 50,885 tons of dry scrap, valued at $1,532,994; 37,536 tons of acidulated scrap, valued at $603,446; and 99 tons of green scrap, valued at $1,725.

In the endeavor to eliminate the obnoxious odor emanating from the hot-air drier, one of the factory men has evolved the idea of building a frame shed immediately back of and of a similar size to the brick chamber or chimney referred to above and closing the top of the chimney so that the dust and vapor can not escape at that point, but must pass on through a passageway into the shed. In this shed, which may be called a condensing house, is a series of vertical baffles over which are arranged perforated water pipes; the water sprinkled from these pipes condenses, to some degree, the vapor as it enters and circulates through the building and also dampens the dust and prevents it blowing over the neighborhood. The water is carried off through an outlet in the floor.

OIL.

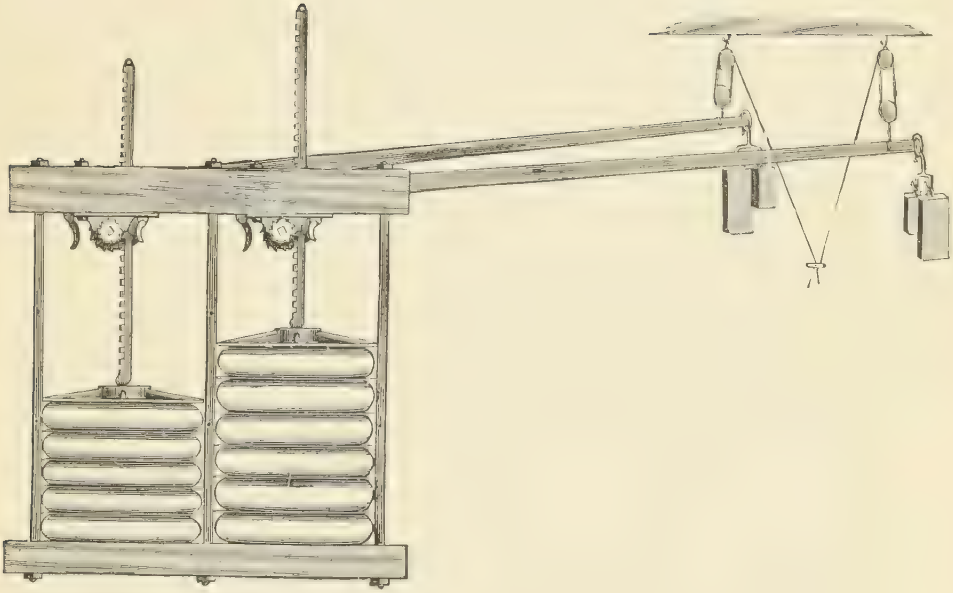
The oily and aqueous liquid flows from the press to the floor, which is made of concrete in most of the recently built plants, and on to a trough leading out to the tanks where the separating is accomplished. It first passes through the receiving tank, where a considerable quantity of the solid matter forced from the press with the liquid is precipitated and drawn off through an opening in the bottom of the tank. The water and oil are separated here to some degree.

As the liquid flows through the series of tanks the separation is made more complete in each one; it may flow directly over the edge of one tank into the next or into a trough built on the inside of the tank along the side next to the one to receive the oil; the latter arrangement is sometimes called a "self-skimmer." As an aid in forcing the oil to the surface and out, an additional supply of water is sometimes let into the tanks through a hose, the open end of which is placed near the bottom so as to avoid disturbing the surface. Hot water is preferable for this purpose, because when cold it chills the oil. Another method, used chiefly in drawing the oil from the cooking tanks, is the use of a jointed iron pipe, called the "leader," passing through the bottom of the tank. The open end or top may be raised or lowered to any desired distance beneath the surface and the oil drawn off without disturbing the water beneath. A pump is usually used in connection with this arrangement. The liquid is usually hot when coming from the presses and requires no heating in the receiving tanks. Some of the factories, however, have installed perforated pipes in the bottom of these so that heat may be applied if necessary.

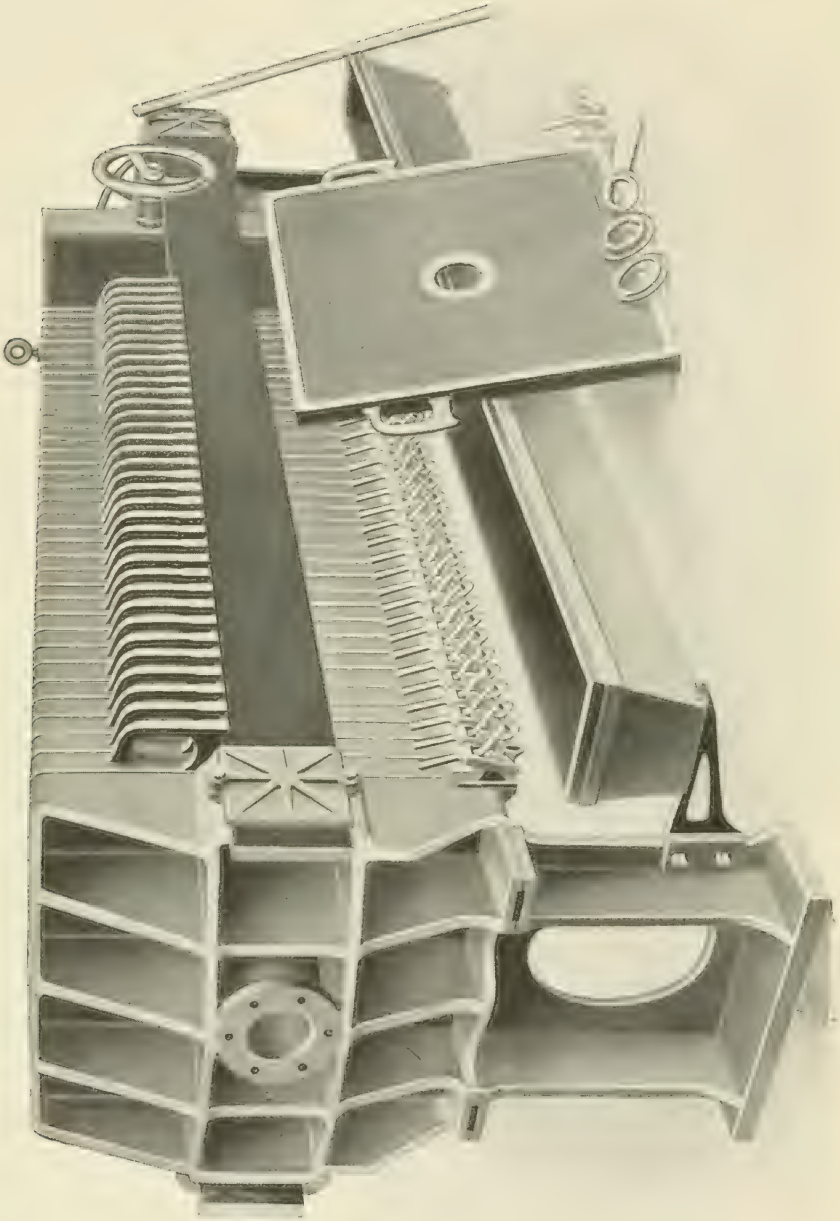
The separating tanks all have a similar arrangement of pipes placed under false bottoms, though only sufficient steam is applied in these to keep the liquid hot, usually about 125° to 150°. The water is drawn from the receiving and separating tanks by means of a "coffee pot" or siphon box 6 by 12 inches in size, built against the inside of the tanks, with the lower end opening about 6 inches from the bottom of the tank. The water, entering here, passes up through the box and out at the top. By the time the oil passes from the last of the series of separating tanks to the cooking tanks it is practically free of water. It is then cooked to the boiling point by steam injected from the perforated pipes placed in the bottom of the tanks, 20 to 30 minutes usually being sufficient time for the cooking process.

After the cooking the oil is sometimes drawn into "cooling tanks," but more frequently it is pumped directly to the storage tanks, which are usually made of metal and are located some distance from the factory. These tanks are without cover, so that the oil may have the benefit of the sun and rain, which improves it by bleaching and washing. Some of the factories have what are known as "catch-all" tanks, into which all the water from the separating and other tanks is run and heated by means of steam introduced by the same arrangement of pipes as has been described above, so that any remaining oil may be extracted. It is said that there is sometimes a considerable quantity of oil saved by this process. The sediment collecting in the bottom of the tanks during the separating and cooking process, consisting of fine particles of flesh, is called "gurry"; this is sprinkled with diluted sulphuric acid, either before or after being conveyed to the gurry-press room, to facilitate the separation of the remaining oil from the flesh particles. It is then cooked 20 to 30 minutes by steam injected by the process above described, and while hot is pressed.

Two forms of presses are used for the gurry. The one most frequently found is very simple in construction; it consists of an iron framework about 10 feet high, forming "bays," each 28 inches wide, in which are a number of steel plates; the gurry is put into canvas bags, about 2 gallons to each; the mouths of the bags are not sewed, but are folded in such a manner as to prevent the semisolid gurry running out. Two bags are placed on each plate, with a total of 100



TWO-BAY OIL PRESS FOR GURRY.



FILTER PRESS FOR GURRY.

to 125 to each bay. The pressure is applied by a lever attached to a pinion working in an upright rack, the lower end of which fits in the head of the press. The bays are usually filled and ready for the pressure by noon, and by evening the process has been completed. The residue, which is a thin, hard cake of scrap, is removed and thrown into the scrap heap, it not being necessary to run it through the drier. The manufacturers of this press can furnish as many bays as are desired by the menhaden factories; a one-bay press costs $70; two bays, $140, and so on; these prices being exclusive of the steel plates, which cost 85 cents each, and the bags.

The economic value of the gurry presses is evident when it is considered that one plant operating a three-bay press gets about 10 gallons of oil and several hundred pounds of scrap a day from the process. The gurry, before pressing, is said to contain equal parts of oil, water, and scrap. The other apparatus which is used in several factories for pressing gurry is a filter press consisting of a series of chambers, 50 in number, formed by recessed plates each 30 inches square. From each side of these plates projecting lugs rest on a pair of parallel bars which are fitted in the frame at each end. The press stands 4 feet high and is 12 feet long. The gurry is pumped in through a channel 3 inches in diameter in the head of the press and distributed over the surface of the filtering medium, which is simply heavy canvas placed between the plates referred to above. The liquid passes through the canvas and runs down and out through cored channels in the lower part of the plates and through outlet cocks to the trough leading to the oil tanks. The advantage of having a separate cock on each plate is that in case one of the cloths should break, that particular plate may be shut off and the filtration need not be interrupted. The solid matter, being retained on the surface of the canvas, gradually fills the chambers until a solid cake is formed in each; the press is then opened, and these are removed and thrown into the scrap heap. The pressure can be regulated by an arrangement which diverts the gurry to the tank from which it has been pumped instead of running it on into the press.

These presses have a capacity of 60 barrels of gurry in 24 hours; one "pressing" can be accomplished in about 3½ hours. The canvas is removed and thoroughly cleaned at least once a day, and an extra set of these is always kept on hand. The gurry in its natural state is so thin that it would run through the press too rapidly, and to guard against this it is necessary to use a filler which gives it a greater consistency. Maple sawdust is generally used for this purpose, the proportion being 2½ to 3 bushels to 10 barrels of gurry.

As the oil flows from the gurry press it is first run into a tank near by, and from there it is pumped to the oil room, where it is rewashed, and if it is found to be sour it is boiled again. It is then generally run to the storage tanks with the other oil. It is the opinion of some of the oil experts that it should be kept separate, as it is of a darker color and inferior quality, but there is such a small quantity of it, as compared with the other oil, that the operators do not bother to provide separate tanks for it.

The gurry is pressed in most of the factories north of Virginia, but only one plant in that State used such a press prior to 1912. The gurry in the North Carolina factories is not used, but is run overboard with the water from the oil tanks.

The yield of oil varies greatly on different parts of the coast, and also from year to year and at different seasons. The fish are always larger and fatter during the fall than at any other season, consequently there is a greater yield of oil during that period. The fish taken from northern waters produce more than those from southern waters; the writer visited one of the northern factories during August, 1913, and was told that a short time previous to his visit they had made 20 gallons, and that the average yield for July had been 16.5 gallons, per 1,000 fish. The maximum yield for the Middle Atlantic States is about 15 gallons, though it is usually less; in the early part of the season it is very much less than that amount. The south Atlantic fish rarely produce more than 8 gallons per 1,000 fish, and frequently it is less than 1 gallon during the early spring fishing. The average number of gallons of oil made from 1,000 fish during the season of 1912 was as follows: Connecticut, 11.73; New York, 11.36; New Jersey, 5.08; Delaware, 7.72; Virginia, 3.72; and North Carolina, 1.98.

The manner in which the oil is handled in the process of separating and cooking has a great deal to do with the amount produced. While the principle is practically the same at all the factories, some oil tenders can extract a greater quantity than others, and also make a superior grade.

Practically all of the crude menhaden oil is sold to dealers in New York, New Bedford, Baltimore, and Boston, where it is refined, bleached, and winter-pressed. The grades, as produced by the refineries, are "Extra bleached winter fish oil," "Bleached winter fish oil," "Light winter-pressed fish oil," and "Brown winter-pressed fish oil." Some is exported in the crude state, but only when the prices in this country are especially attractive or when the foreign oils are not available. It is graded from samples sent by the manufacturers to the oil dealers, according to the color and condition. The standard grades are A, B, C, and D, varying from a clear amber color to a dark brown, or in some cases nearly black, depending chiefly on the condition of the fish when reaching the factory. When fresh they usually produce a clear, sweet oil; if they are putrified the oil is dark, and if the decomposition has reached a well-developed state, it is likely to be "off in smell," having a disagreeable odor as of decayed fish.

The quality of oil made from fat fish is superior to that from thin ones. There is a noticeable difference in what is made from fish caught in Chesapeake Bay and that made from fish caught by the same fishermen at sea, the latter being of a superior quality. Grade A from sea fish is one to three shades lighter than the same grade from the bay fish. Menhaden oil is used chiefly in the manufacture of paints and varnishes. Some is also used in tempering steel and tanning leather, though a very small quantity is used for the latter purpose as compared with what was used in former years, because the curriers are now using mineral oils and compounds which are less expensive than fish oil.

An apparatus for evaporating the water which is separated from the oil and known as "stick water" has recently been installed in one of the factories. It is an oval-shaped iron shell standing 8 feet high, 4½ feet wide, and 18 feet over all. The working part consists of a cylinder of 96 tubes, held in place by bearings at each end of the casing and made to revolve by means of gearing on the outer ends of the hollow shaft. Steam is introduced at the end of the rotating tube shaft and the condensed water is drawn off at the opposite end. The construction of the drainage from the steam tubes is such as to prevent the water collecting in any part of the steam drum or tubes. The material to be evaporated is let in through an opening at the bottom of the machine, at the same end the steam enters, and the finished product is drawn off through an opening in the opposite end. The vapor arising from the material is drawn off by a vacuum pump attached by pipe to an opening at the top of the machine. One 20-horsepower pump is sufficient for two evaporating machines. Exhaust steam can be used to do the evaporating with this machine to a decided advantage, as it will do the work as well as low-pressure live steam. The residue or "stick" will average about 9 per cent ammonia; it is a brownish, sticky substance and can be used as a fertilizer when mixed with other fertilizer materials. The writer saw some at the plant referred to that had been mixed with fish scrap—1 pail of stick to 4 pails of acidulated scrap and another mixture of 1 pail of stick to 3 pails of scrap. It seemed to be well mixed and was not "gummy," though it would probably have to be dried before it could be placed on the market. The analysis of "stick" is: Moisture, 15.99; grease, 0.16; ammonia, 9.24. This machine has been used at reduction plants with success, and it would seem that some of the larger menhaden plants might use it to advantage. The cost of a machine is approximately $4,000.

FISHERMEN.

The crews of the northern steamers are made up chiefly of Newfoundlanders and Nova Scotians. Those on the southern vessels are mostly natives, and, with the exception of the captains, mates, engineers, firemen, and some of the strikers, are colored. Many of the steamers also carry white pilots, because the captains are too busy directing the fishing operations to tend the wheel. The men, especially in the south, usually live adjacent to the factory for which they are fishing and go home as frequently as their work will permit. The captain, who must be a practical fisherman, in addition to having a knowledge of the coast, receives no stipulated salary but is paid a bonus of 12½ to 18½ cents for each 1,000 fish caught. The monthly pay received by the other members of the crew is as follows: Mate, $100, or $50 and a bonus of 4 cents per 1,000 fish, or $25 and a bonus of 5 cents per 1,000 fish; pilot, $85 to $90; engineer, $90 to $125; assistant engineer, $60 to $80; firemen, $35 to $45; striker, $60, or $35 to $40 and a bonus of 1 or 1½ cents per 1,000 fish; cook, $60 to $75; and $35 to $45 for the fishermen. In addition to this the employers furnish subsistence for the entire crew. The custom in the fisheries of North Carolina differs somewhat from the above wage scale, in that the entire crew works on shares and they also find their own food; seventy-five to eighty-five cents is allowed the crew for each 1,000 fish taken. Of this, the captain gets 15 cents, and the others 5 cents each, but the captain usually gives the mate an additional 2½ cents, the cook 1 cent, and the engineer 1 to 2 cents per 1,000.

FACTORY EMPLOYEES.

The men employed in the fish factories of the Chesapeake Bay region are secured chiefly from brokers in Baltimore; they are of various nationalities, including German, Irish, Polish, and Norwegian; the writer saw a man at one of the Reedville plants said to be an Indian and a very good workman. Those on the Delaware and New Jersey plants are practically the same class as in Virginia and are brought from Baltimore and Philadelphia. Many of the men at the New York factories are Portuguese.

In addition to subsistence furnished them, the monthly pay of the men at the various factories is as follows: Foremen, $50 to $125; assistant foremen, $40 to $80; engineer, $35 to $100; assistant engineer, $25 to $60; firemen, $30 to $40; oil tenders, $30 to $100; machinist, $50 to $100; seine menders, $35 to $100; cook, $60 to $90. There are also a number of others doing general work about the factory at wages ranging from $15 to $40. It is quite difficult to hold the latter class of men any length of time, and as an inducement some of the operators offer a bonus of $5 per month if they remain throughout the season. This custom, however, prevails in only a few plants in Virginia.

LAWS GOVERNING MENHADEN FISHING.

The legislatures of most of the States in which the menhaden industry is prosecuted have adopted laws governing the work. In New York a license of $50 is required for each steamer of 50 tons or more, and $25 for every other vessel engaged in fishing with nets in the tidal waters of the State for the purpose of making oil or fertilizer from the fish product taken; and a fine of not less than $100 is provided for taking food fish for the purpose of converting them into oil and fertilizer. The New Jersey law imposes a license of $100 for each steam vessel of not more than 50 tons net, $125 for each steam vessel of over 50 tons and not more than 100 tons net, and $200 for each steam vessel of over 100 tons net taking menhaden with purse seines. The law in Delaware requires the payment of a license of $100 for each steamer not over 125 net tons, and $200 for each steamer over 125 net tons employed in the taking of menhaden by means of purse seines.

The menhaden fishermen of Maryland are required to pay a license of $25 for each net used and are not allowed to fish with such nets at any point north of a line drawn east from Sandy Point to Love Point. The penalty for violation of this law is a fine of $50 and confiscation of the boat and all the fishing gear. The Virginia law is the most severe of all the menhaden fishing laws; it states that "it shall be unlawful to take, catch, or round up with a purse net for the purpose of manufacturing into guano, food fish to the amount greater than one per centum of the whole catch without immediately opening the net and turning loose any such food fish while yet alive; or for any steamer or vessel licensed for the purpose of menhaden fishing to catch any food fish for the purpose of marketing same; or for any person, firm, or corporation to have in possession food fish to a greater amount than one per centum of the bulk for the purpose of manufacturing them into guano or oil, except that herring caught in pound nets may be marketed and used for the purpose of such manufacture. Any person, firm, or corporation violating any portion of this section, or having in their possession as much as one per centum of food fish among menhaden caught for the purpose of manufacturing into guano or oil, shall be fined not less than one thousand nor more than three thousand dollars, and the license on such person's boat or net shall be revoked for the remainder of the season." It is believed that the menhaden fishermen of Virginia are in sympathy with this statute and endeavor to abide by it. The license for a steamer fishing in the State waters is $100, and nonresidents are excluded. The North Carolina statutes provide no license for fishing with purse seines for menhaden.

MUSSEL RESOURCES IN TRIBUTARIES OF THE UPPER MISSOURI RIVER

By ROBERT E. COKER, *Director*

AND

JOHN B. SOUTHALL, *Shell Expert*

United States Biological Station
Fairport, Iowa

Appendix IV to the Report of the U. S. Commissioner of Fisheries for 1914

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MUSSEL RESOURCES IN TRIBUTARIES OF THE UPPER MISSOURI RIVER.

By Robert E. Coker, *Director*, and John B. Southall, *Shell Expert, United States Biological Station, Fairport, Iowa.*

FIELD OF INVESTIGATION.

The Missouri River itself has been known to be without shell resources, although some of its tributaries may compare favorably in mussel fauna with streams of other divisions of the Mississippi-Missouri Basin. The fact of the general poverty in mussels of the Missouri River has led to an almost entire neglect of its more favored tributaries until quite recently, when shelling operations have been undertaken in such streams as the Osage River in Missouri and the James River in South Dakota.

During the summer of 1912 the Bureau conducted a reconnaissance of lakes and streams constituting the headwaters of the Mississippi River in Minnesota,[a] and it was hoped to extend the survey this season westward to the headwaters of the Missouri. Such a desire was strengthened by the receipt of information that important shells were being found in the James River, and perhaps in the Vermilion River of South Dakota also. Accordingly, in July, 1913, Mr. J. B. Southall, shell expert of the Fairport station, made an examination of several streams, principally the James and the Vermilion Rivers. The director was able to visit only the James River at Huron, and the Vermilion River at Parker, S. Dak. For observational data, therefore, this report is based principally upon the field notes and collections of Mr. Southall.

It may be recalled that the extreme upper portions of the Missouri and the Mississippi Basins, respectively, are not adjacent, but are separated by that far-reaching arm of the Hudson Bay drainage constituting the basin of the Red River of the North. The southernmost units of the Red River system are the Ottertail River in Minnesota and Lake Traverse and the Cheyenne River in the eastern and southern portions of North Dakota. The party en route for the James River found it convenient to make a few observations on the Red River at Fargo and the Cheyenne River at Lisbon.

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[a] Wilson, Charles B., and Danglade, Ernest: The mussel fauna of central and northern Minnesota. Bureau of Fisheries Document no. 503, 26 p., 1 map. 1914.

Mussels of central and northern Minnesota. Bureau of Fisheries Ecomomic Circular no. 3, 6 p. 1912.

The James River was first examined at Oakes, N. Dak., from whence the party proceeded by rail from point to point down to the mouth of the river, stopping at Columbia, Frankfort, Huron, Riverside, Milltown, and Lesterville, S. Dak. (See map.)

The Vermilion River was examined at Parker, Davis, Centerville, and Vermilion, the latter point being 7 miles above its mouth.

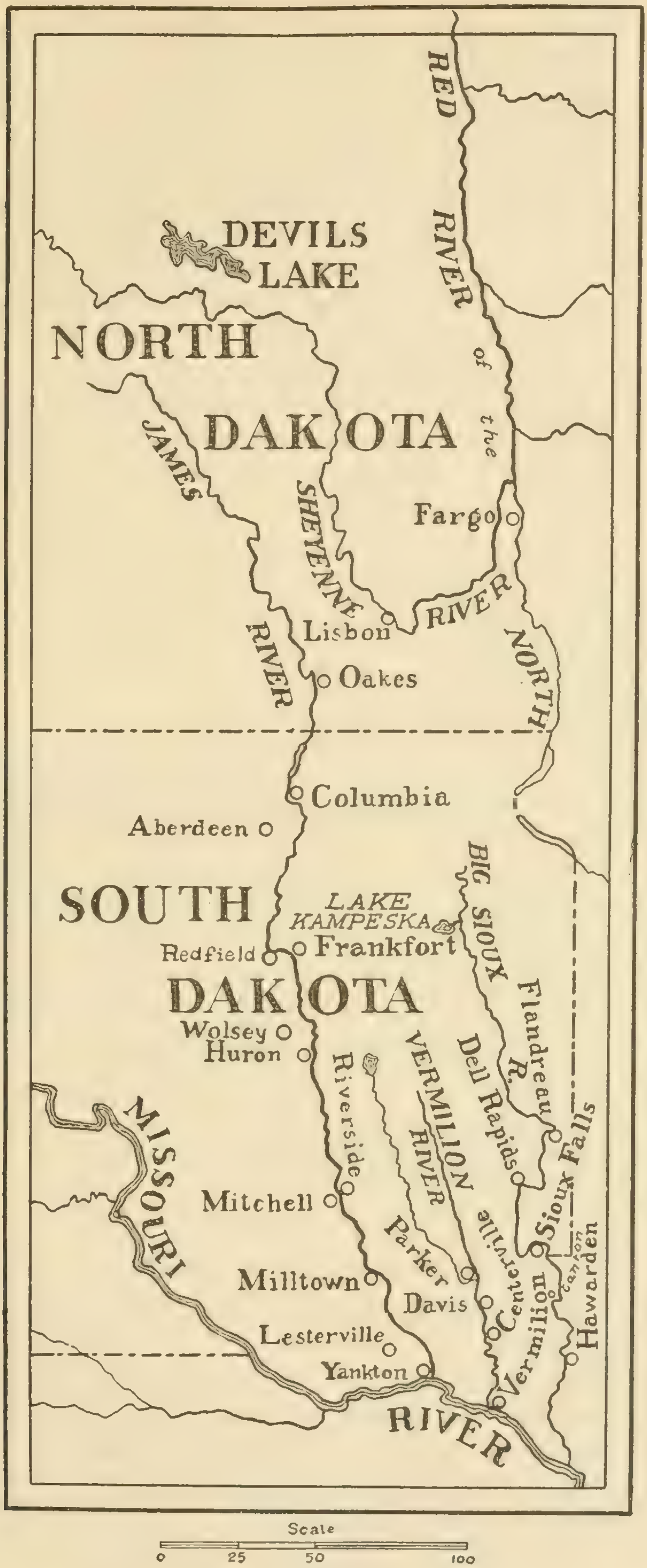
The Big Sioux River was visited at Flandreau, Dell Rapids, Sioux Falls, Canton, S. Dak., and Hawarden, Iowa. Examination was also made of Lake Kampeska, connected with the Big Sioux River.

The more western and northern tributaries of the Missouri generally were not included, although side trips were made to the Bad River at Philip, S. Dak., the Cheyenne River at Wasta, S. Dak., and Rapid Creek, a tributary of the Cheyenne, at Rapid City, S. Dak.

Some species of mussels were found in every locality visited except in the streams west of the Missouri; but the only streams containing mussels of economic quality and abundance were the James River, between Riverside and Lesterville, and the Vermilion River, near its mouth. It may well occasion surprise to find a luxuriant mussel fauna narrowly circumscribed within what is otherwise, for mussels, a broad and barren waste. The rivers of the region under consideration do indeed form an integral part of the great Mississippi-Missouri system, in which the Unionidæ have reached their greatest development; but the James and the Vermilion Rivers are, by water connection, far away from the nearest prolific mussel streams. Constituting a part of the greatest mussel plantations, metaphorically speaking, these particular fields are within the abandoned corner, and their productivity arouses a peculiar interest. Unquestionably these rivers have been stocked from streams lower down in the basin, and it will appear that there are some facts to suggest that the stocking is continued from time to time, though occurring somewhat spasmodically.

JAMES RIVER.

The James (or Dakota) River rises in the west central part of Wells County, N. Dak., and, after flowing in a southerly direction for a distance of about 450 miles, enters the Missouri a short distance southeast of Yankton, S. Dak. The stream itself is permanent, although it is practically devoid of perennial tributaries, and its basin is long and narrow. The region through which it flows is covered generally with the glacial deposits of the Quaternary. One may scarcely speak of a valley. In the upper portions examined the river flows through a seemingly level prairie; the stream is sluggish and comparatively wide (80 to 100 feet), with a depth of 1 to 2 feet (Oakes, N. Dak.). The low banks, composed chiefly of blue clay, are subject to overflow, while the bottom is soft and mucky. Neither live mussels nor empty shells were found.



Map of the James, Vermilion, and Big Sioux Rivers.

About 20 miles below Oakes the river widens to form a slough or lake, approximately a mile wide and about 22 miles long, extending to within a couple of miles of Columbia, S. Dak. The depth in this lake-like portion is 3 to 10 feet. Apparently the lake is well stocked with pickerel and bullheads, so that good fishing is afforded in the deeper places. At Columbia the river becomes extremely narrow, with a width of only 15 feet and a depth of 6 inches to 3 feet, and displays a strong current of 3 to 4 miles per hour. The bottom is variously sand, gravel, and soft mud, and the water has a reddish or iron-rust color. Living mussels were not seen, but many empty shells of *Anodonta grandis* (floater) were found.

Similar conditions seem to exist for a stretch of about 50 miles, or as far as Frankfort, but at the latter place a few scattering beds of mussels were observed. The shells were too thin for commercial use and comprised the following species:

Anodonta grandis, floater.
Symphynota complanata, white heel-splitter.
Lampsilis ventricosa, pocketbook.
L. luteola, fat mucket.
L. gracilis, paper-shell.
Quadrula undulata, three-ridge.
Arcidens confragosus, rock pocketbook.

In the lower course we find the river a generally sluggish stream with a width of 50 to 80 feet and a depth of 3 to 10 feet at ordinary stages, although there are occasional short reaches of shallow water connecting the longer stretches of more lagoon-like character. Here a river valley is more noticeable; the river forms the deepest part of a trough representing the broad ancient river bed, about a mile in width and some 50 to 75 feet in depth. From Huron to Mitchell the river has a fall of 30 feet in 75 miles (Todd and Hall).[a]

At Huron the following species of mussels were found, listed in order of apparent abundance:

Anodonta grandis, floater, 48 per cent.
Symphynota complanata, white heel-splitter, 30 per cent.
Lampsilis luteola, fat mucket, 8 per cent.
Quadrula undulata, three-ridge, 7 per cent.
Lampsilis ventricosa, pocketbook, 5 per cent.
Quadrula coccinea, sometimes called "flat niggerhead," 2 per cent.

The percentages stated are based upon a count of shells in a pile left by a pearl fisher.

Even the better shells here are too light as well as too small for effective commercial use, but it was learned that fishing for pearls was prosecuted at certain times by itinerant pearlers.

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[a] Todd, J. E., and Hall, C. M.: Geology and water resources of part of the lower James River Valley, South Dakota. Water Supply and Irrigation Paper no. 90, U. S. Geological Survey, Washington, D. C., 1904.

A very remarkable shell was found at Huron by Mr. J. B. Southall. The shell clearly can not be identified with any described species, but as further search failed to produce another example it scarcely appears justifiable to regard this unique specimen as representing a new species. The accompanying illustrations (fig. 1, 2, and 3, pl. I) give an idea of the form and appearance of the shell, which seems to combine characters of the three-ridge (*Quadrula undulata*) and the fat mucket (*Lampsilis luteola*). The question is often asked: Do mussels ever hybridize? The present example may suggest an affirmative answer, for, in the absence of further information, the crossing of two known forms is the only apparent explanation of the anomaly presented. Unfortunately, the peculiar characters were not noted until after the shell in question, along with a number of others, had been cleaned and the meats discarded.

At Riverside commercial shelling was found in progress. Here one fisherman, with an assistant, had taken 20 tons of shells up to the date of our visit (July 27, 1913). Approximately 90 per cent of the shells taken were the three-ridge (*Q. undulata*). Other species observed were *Q. coccinea* (flat niggerhead), *Q. postulosa* (pimple-back), *Q. lachrymosa* (maple-leaf), *L. ventricosa* (pocketbook), *L. luteola* (fat mucket), *L. recta* (black sand-shell or long John), *L. alata* (pink heel-splitter), *L. gracilis* (paper-shell), *L. fallaciosa* (slough sand-shell), *Arcidens confragosus* (rock pocketbook), *Tritogonia tuberculata* (buck-horn or pistol-grip), and *Symphynota complanata* (white heel-splitter).

The three-ridges were of medium size, clear in color, and not heavy, having faintly iridescent tips that were too thin for buttons. The other shells generally were too light or too scarce to be of value, but a few pimple-backs, maple-leafs, and fat muckets were suitable for market.

This fisherman had found a large number of pearls, many of which were of some value. An interesting fact was the large percentage of "dead" pearls. About two-thirds of the catch were entirely "dead" and of a brown color. The majority of them were perfectly spherical. Even with the large percentage of worthless material, the pearling was evidently not unprofitable, and the good pieces altogether were probably worth upward of $500.

About 3 miles below Riverside there was another fisherman who had taken out about 15 tons of shells. The mussels were gathered with a coke or coal fork, having a piece of 2 by 4 lumber fastened to the handle, the length of this piece being according to the depth of the river. This fisherman had a novel way of anchoring his boat. At each end of the boat a hole was bored through the bottom large enough to insert a piece of 1½-inch pipe, making a water-tight joint. These perpendicular pipes, rising to the level of the gunwales of the boat, served as sockets or sleeves through which a long iron rod could be shoved into the soft mud bottom of the river. By anchoring in this way the boat was kept abreast of the current, while the fisherman used the sides as a fulcrum for the handle of his fork. After gathering all the mussels possible within reach he would pull up the rods, let the boat drift downstream a suitable distance, or beyond the portion of river just worked, and then anchor and resume operations as before.

In places like that just described, where a carload or more of shells can be taken in a season, commercial shelling may be followed profitably. From Milltown to Lesterville the river is very productive. Approximately 400 tons of shells have been taken out of the river between these two points.

At Milltown, mussels were gathered by means of the basket-rake dragged by a power-boat. The rake was peculiar in being without teeth but having a square brail made of $\frac{1}{4}$ by $1\frac{1}{2}$ inch flat iron, to which was fastened a wire basket of 1-inch mesh. With each boat was a crew of four men, three to work with the rakes and one to operate the engine. One dragged the rake at the rear of the boat, while the other two worked at the sides. In this manner a strip of the river bottom 6 feet wide was thoroughly scraped. One crew said that they had gathered 3 tons of mussels in three hours.

Of all the shells gathered by the party at various points on the James River, or observed at the clammer's camps, no small ones were seen. Mr. Kennedy, a shell dealer, informed our party that he had prospected the James River from Riverside to its mouth, and had not found any small shells. The basket-rake implement employed on this river and described above would have taken small shells as well as larger ones had they been present. This poverty of young mussels may be due to the fact that long-continued low stages of the river cause the run of fishes that are essential to the reproduction of the mussels to occur only at irregular intervals (see also p. 12). We were told by the people who live along the river that in some years fish appear in large numbers, but that usually the fishing was very poor, only an occasional bullhead being caught.

CHARACTER OF THE JAMES RIVER DRAINAGE AREA.

Particular attention was not given to geological conditions, but because of the interest attached to the rather isolated mussel beds in this semiarid region, it may be instructive to refer to the character of the country through which the river passes, especially as it affects the water supply. The data are gleaned largely from the report of Todd and Hall previously cited.

The general surface is covered variously by sand, clay, and gravel till and by stream deposits of recent geological times. Tertiary and

Upper Cretaceous formations are wanting, so that the glacial deposits overlie immediately the Lower Cretaceous, Niobrara, Benton, and Dakota formations. The Dakota formation is of particular interest as being the principal source of the artesian wells which yield such abundant flows of water and have a profound effect upon the agricultural development of the region (as about Mitchell, Huron, and Artesian). Finally beneath the Cretaceous (Triassic and Jurassic being wanting) there is encountered the Algonkian granite and Sioux quartzite, the latter forming the bedrock over a large part of the valley.

The James River intersects three low terminal moraines which form long loops directed southward. Previous to their formation the ice had covered the whole area to a depth of several hundred feet and pushed south and west to the vicinity of the Missouri River, where it rested for a time and formed the first, or Altamont moraine; then retreated and formed the second, or Gary moraine, about Mitchell, and finally the third, or Antelope moraine, which is found west of Wolsey. Between these moraines many lateral valleys, generally dry, lead into the James River.

While perennial streams are rare, springs are not uncommon along the river. Shallow wells may be had, although these are not permanent except when located in the valley or basin, since they depend for supply upon the surface waters, which are very limited in amount. There are deeper pump-wells in which a tubular or force pump is often necessary, or where the water supply is reached after passing through an impervious layer. Three distinct geological horizons supply such water in this area, particularly in the northern part, viz, (1) the sands below the till; (2) either porous strata or crevices, probably in the chalk; and (3), of most importance, the sandstone below the chalk, which is the first regular water-bearing stratum of the Benton-Dakota series. It is from this source that the great artesian wells of this district derive their supply. (Todd and Hall.)

The drainage area of the James River lies in a region of moderate rainfall, the average annual precipitation being between 20 and 25 inches, occurring principally from May to August. The annual precipitation in this valley fluctuates widely. The following data from the Weather Bureau, "Summary of Climatological Data for the United States by Sections," may serve as illustration:

Stations.	Period.	Annual precipitation.		
		Lowest.	Highest.	Mean.
Aberdeen	1891–1908	15.96	38.39	27.05
Redfield	1898–1908	13.31	30.76	20.34
Huron	1882–1908	13.56	28.93	21.04
Mitchell	1892 1895–1908	16.97	36.14	24.05

NATURAL PROPAGATION OF MUSSELS IN RELATION TO FLOOD STAGES IN THE JAMES RIVER.

From the account of the drainage area just given it is evident that the ground waters, although plentiful at great depths, can supply but a small flow to the river. While, therefore, the river may at all times cover sufficient bottom to support an abundance of mussels, it can have a considerable volume only when there is a direct inflow of surface waters after periods of rainfall. It is even probable that light rains are so completely absorbed by the loose dry soils that the river is only slightly affected by them.

The effect of such conditions upon the stages of the river is of particular interest in connection with the observations regarding the mussels. The fact that scarcely any small mussels were found led to the inference, as previously mentioned, that the opportunity for natural propagation of the mussels occurred only at irregular intervals.

From the data regarding the average river stages given in the following table,[a] it appears that while the James River is occasionally subject to high stages it ordinarily maintains a very low level. Thus, during the entire year 1911 the monthly average stage did not attain 3 feet in any month, and exceeded 1 foot in only three months, viz, February (1.1 feet), April (2.6 feet), and May (2.2 feet). The conditions in 1913, up to September, were nearly the same, the spring stage being just a little later. On the other hand, during the three preceding years (1908–1910) higher averages were made, particularly during 1909 and 1910, when monthly averages of 11.7 feet and 10.9 feet, respectively, are found in March. The highest recorded stage, 14.6 feet, was made March 15, 1910.

If the natural propagation of mussels in the river depends upon a run of fishes during high stages, it is evident that favorable conditions had not occurred since 1910, and consequently we could not expect to find small mussels in 1913, except as they might have developed in favored spots where fish were left. It is of interest that from observations of the mussels it should have been assumed that no flood stages of the river had occurred recently, and that the records of river stages, subsequently obtained, should have offered confirmation of this presumption.

Since most of the species of mussels are in an early stage parasitic upon fish and remain in parasitism for a period of time, it follows that for a particular bed of mussels to be propagated the fish must either come to that bed infected with mussels, or else they must be on the bed when mussels are breeding, become infected from that bed, and remain or return to drop the mussels in the same vicinity at the expiration of the period of parasitism; in either case the regular or irregular occurrence of flood stages is of considerable moment. This factor would more particularly affect the distribution and propagation of mussels above the point on the river to which fish ordinarily have free access. As a matter of fact, the James River is so broken up that this point is comparatively low in its course.

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[a] These data were kindly supplied by Mr. S. W. Glenn, section director in the Climatological Service of the Weather Bureau, Huron, S. Dak.

There are small milldams at Milltown, Riverside, and Huron. These dams are only 3 to 6 feet high, but are not provided with fishways and are certainly a barrier to the movement of fish at ordinary stages. Even without these, the frequent stretches of riffles between the more lagoonlike portions of the river would ordinarily prevent the free movement of fish. In any event, the fish could seldom pass above Milltown, and it has already been noted that the principal mussel beds are between Lesterville below and Milltown above.

AVERAGE STAGES OF WATER IN JAMES RIVER AT HURON, S. DAK., FROM OBSERVATIONS BY THE WEATHER BUREAU, DEPARTMENT OF AGRICULTURE.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	Feet.	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*
1908	(a)	[b] 0.2	3.1	1.9	2.3	4.2	1.8	0.2	0.0	0.2	0.4	(a)
1909	(a)	(a)	11.7	4.8	2.1	2.4	2.6	1.4	.6	.5	.4	(a)
1910	(a)	(a)	10.9	5.6	4.3	1.6	.3	.0	−.2	−.3	−.1	(a)
1911	(a)	(a)	.8	.5	.6	.3	−.2	−.3	−.4	−.3	−.3	−0.4
1912	(a)	[c] 1.1	.6	2.6	2.2	.8	.3	.0	.1	.2	.4	.2
1913	0.1	.0	.1	.6	2.4	1.9	.3	−.2	−.4	......	......	......

Highest stage, 14.6 feet, Mar. 15, 1910. Lowest stage, −0.5 foot, Sept. 3, 4, and 5, 1911, and Sept. 15 to 25, 1913.

[a] River frozen entire month. [b] River frozen 1st to 23d. [c] River frozen 23 days.

VERMILION RIVER.

Conditions in the Vermilion River are similar in a smaller way to those of the lower James River. This stream is parallel to the James River and only 20 to 30 miles eastward.

The Vermilion River rises at Lake Herman, Lake County, S. Dak., and after flowing about 110 miles in a southerly direction enters the Missouri River just below Vermilion, S. Dak. The uppermost point of the river examined was at Parker, where it is composed of lagoonlike portions 2 or 3 feet deep and 10 to 40 feet wide, connected by narrow riffles, with very small flow of water. Some large white heelsplitter shells were observed, but mussels were not abundant.

The river was next examined at Davis, where it flows through a trough in the seemingly level prairie from 50 to 60 feet wide. At an ordinary stage of water the stream is 20 to 30 feet wide and 1 to 2 feet deep, having a gravel and sand bottom. Only a few mussels were found.

At Centerville there is a dam, forming a mill pond 100 to 150 feet wide and about 2 miles long. At the head of this pond there is a mussel bed of fair size, the whole bed containing about two carloads of commercial shells. At the time of the investigation some men were gathering the mussels in search of pearls. During the first part of the season $500 worth of pearls were found. The pearlers had been discarding the shells, but were considering placing them on the market.

The next station (Vermilion) is about 7 miles above the mouth of the river. As the river is navigable for a short distance here, a boat was hired and a trip 7 miles upstream was made to the mouth of a long drainage ditch. Few mussels were found, and these, though large old shells, were mostly thin-shelled species and were of no value. The drainage ditch is 20 miles long, 90 feet wide at the upper end and 110 feet wide at the lower end. It was begun during the winter of 1911 and opened up the last week in May, 1913. It was constructed for the purpose of straightening the course of the river and furnishing better drainage than the old river bed, which was so built up as to be higher than the surrounding country. The ditch has therefore wholly supplanted the old bed, leaving it high and dry. Many dead mussels are found in what had been the deeper portions of the old river. The mussel fauna of the 20 miles and more of old river bed, which was thus exposed to view in its entirety, would amount in all to about three carloads of large shells, averaging considerably larger than those of any stream or mussel bed which we have yet encountered. About one carload of these shells, the best and most available ones, have been placed on the market.

In all, 11 species of mussels were found in the river, 7 of these being of good commercial value. The commercial species are *Lampsilis ventricosa* (pocketbook), *L. luteola* (fat mucket), *Quadrula undulata* (three-ridge), *Q. coccinea* (flat niggerhead), *Q. lachrymosa* (mapleleaf), *Q. pustulosa* (pimple-back), and *Symphynota complanata* (white heel-splitter). Other species found were *Lampsilis alata* (pink heel-splitter), *L. gracilis* (paper-shell), *L. recta* (black sand-shell or long John), and *Anodonta corpulenta* (slop-bucket).

EXAMINATION OF OTHER STREAMS.

Big Sioux River, which is about 230 miles long, rises in the northwest part of Grant County, S. Dak., and, after flowing in a southerly direction through a narrow valley in the rolling prairie, enters the Missouri River just above Sioux City, Iowa. In the upper part of the river the bottom is gravel and sand, while at Dell Rapids and Sioux Falls it is quartzite, and rapids and small waterfalls prevail. The bed of the river in its lower part, from Canton to the mouth, is composed of fine shifting sand and silt.

The river was examined from Flandreau, S. Dak., to Hawarden, Iowa. Only a few mussels were found, and of these only the following 7 species were of commercial value: *Lampsilis recta* (black sand-shell), *L. ventricosa* (pocketbook), *L. luteola* (fat mucket), *Quadrula undulata* (three-ridge), *Q. coccinea* (flat niggerhead), *Q. pustulosa* (pimple-back), and *Symphynota complanata* (white heel-splitter). The noncommercial species found were: *L. gracilis* (paper-shell), *L. alata* (pancake or pink heel-splitter), *Anodonta corpulenta* (slop-bucket), *Alasmondonta truncata* (elk-toe).

Lake Kampeska, 3½ miles wide and 5¼ miles long, lying 4 miles northwest of Watertown, S. Dak., is practically an isolated lake, which receives its main supply from the Big Sioux River at flood stages through what is usually termed the ''outlet'' at the eastern end of the lake. The gently sloping banks are chiefly fine gravel and sand, and the average depth is about 10 feet. The mussels were very small and dwarfed, and were too thin for commercial use. The following species were observed: *Anodonta grandis footiana* (floater), with shells so thin that ordinary print can easily be read through them; *Lampsilis ventricosa* (pocketbook); *L. luteola* (fat mucket) (1 specimen gravid July 23, 1913); *Strophitus edentulus* (squaw-foot); *Symphynota complanata* variety *katharinæ* (white heel-splitter).

Bad River was examined at Philip, S. Dak., and was found to be almost dry, with the exception of a few water holes, and no mussels were found.

Cheyenne River at Wasta, S. Dak., is very swift and muddy. The bottom is covered with large rocks, along with the mud and sand. No mussels were found.

Red River of the North, where examined at Fargo, N. Dak., is about 50 to 75 feet wide, the bottom being chiefly very soft with a considerable proportion of decaying vegetation. Above the dam at this place the river is 6 to 10 feet deep. Mussels were quite plentiful in the mill pond. *Q. undulata* (three-ridge), *Q. lachrymosa* (maple-leaf), and *Q. pustulosa* (pimple-back) were the only commercial shells found. Other species collected were: *L. ventricosa* (pocketbook); *L. recta* (black sand-shell); and *L. alata* (pancake).

Sheyenne River, a tributary of the Red River of the North, was examined at Lisbon, N. Dak. At this place it is a small stream 30 to 50 feet wide and about 1 or 2 feet deep. In the mill pond above the town we found quite a few mussels, but they were too thin for commercial use. The following species were noted: *Q. undulata* (three-ridge); *Q. coccinea* (flat niggerhead); *L. luteola* (fat mucket); and *A. grandis* (floater).

SUMMARY.

In contrast to the tributaries of the upper Mississippi, those of the upper Missouri, like the main stream itself, are generally deficient in mussel resources. The James and Vermilion Rivers are exceptions, the James River particularly having supported during the past year (1913) a shell fishery of some importance. Pearl fishing has been pursued in both streams for some years. The shell fishery on the James River is principally between Riverside and Lesterville. Modifications of the usual methods of fishing are employed to advantage. (See p. 9, 10.)

The principal shell is the *Q. undulata* (three-ridge). Several other economic species are found in less abundance. The variety of shells is limited, 14 species in all being collected.

Pearl fishing has been pursued on the Vermilion River and some shipments of shells have been made recently, but the stream is too small to be important.

It is probable that the self-perpetuation of the mussel beds in the James River depends upon the occurrence of unusual flood stages that allow opportunity for the entrance of fishes from the Missouri River.

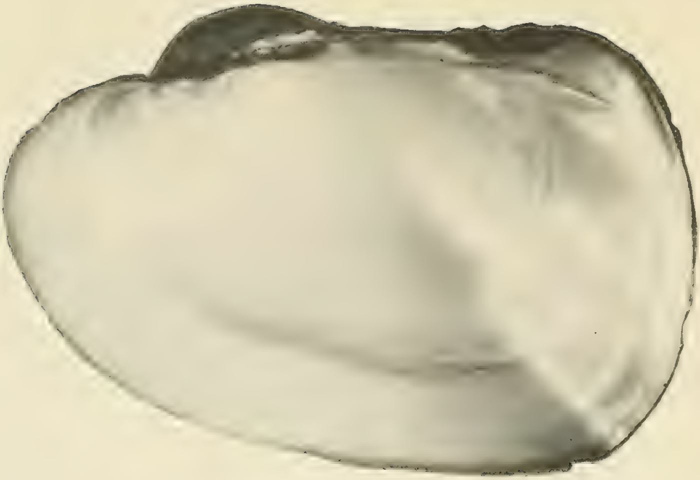

FIG. 1.

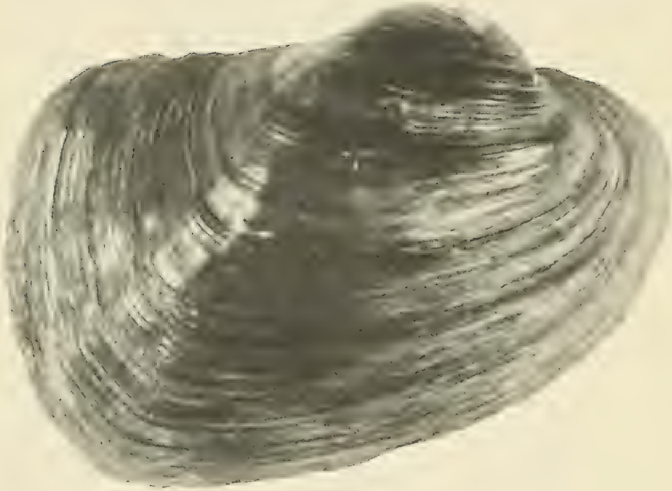

FIG. 2.

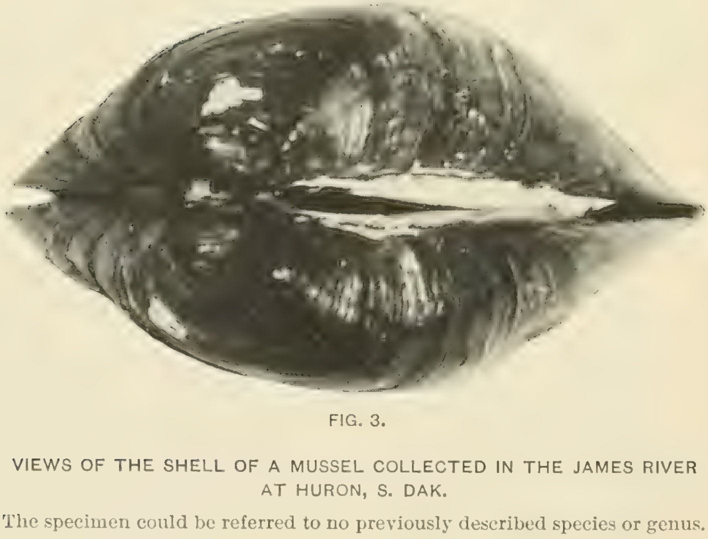

FIG. 3.

VIEWS OF THE SHELL OF A MUSSEL COLLECTED IN THE JAMES RIVER AT HURON, S. DAK.

The specimen could be referred to no previously described species or genus.

APPENDIX.

DESCRIPTION OF SHELL FOUND IN THE JAMES RIVER AT HURON, S. DAK., JULY 27, 1913.

(Fig. 1, 2, and 3, pl. I.)

Form of shell.—Subtriangular, the anterior margin forming the rounded apex of the elongated triangle, the posterior margin forming the base; dorsal margin nearly straight; ventral margin about equal in length to dorsal but slightly curved. Much inflated; the umbones high, arched, and nearly meeting; umbones situated well forward, one-third of distance from anterior margin. Greatest inflation in region of umbonal slope.

Sculpture.—A pronounced ridge extends along posterior border of umbones to postero-ventral angle of shell; the anterior border of the ridge is somewhat roughened; a slight but distinct furrow limits the posterior border of the ridge. Just beneath each of the four upper concentric color rings are pronounced ridges in the anterior portion of the shell. Rest-markings consist of three or four short concentric ridges, very distinct but thin and close together.

Color.—Generally brownish straw-color; greenish in highest part of umbones, yellowish anteriorly and ventrally, dark brownish in posterior portion. The specimen in hand shows six distinct dark concentric rings—the so-called "rest" or "growth" rings.

Internal aspect.—Shell cavity very deep; umbonal cavity deep; the shell relatively thin; nacre lustrous white anteriorly, iridescent bluish or violet in thin posterior third. Cardinal teeth double in both valves, but compressed and relatively weak, especially so in right valve; anterior much stronger than posterior in left valve; anterior somewhat stronger than posterior in right valve. Lateral teeth long, compressed, blade-like, elevated, slightly curved, double in left, single in right valve; lateral teeth scarcely continuous with cardinal teeth; hinge plate above lateral teeth practically wanting. Anterior retractor impression separate from anterior adductor, both roughened; posterior adductor impression smooth; pallial line not conspicuous, broad and faintly striate in anterior half; dorsal muscle scars scarcely visible.

Characteristic features of the shell are its triangular or pyramidal form and its remarkable inflation, which are strongly suggestive of the inflated types of *L. luteola;* its compressed sharp teeth, which are of the *Lampsilis* type to an extreme; the color of epidermis and character and color of nacre, which find correspondence only in species of *Quadrula*, especially in *Quadrula undulata*. The pyramidal shape of the shell is also suggestive of *Q. undulata*. It is not possible at the present time to place the specimen in any described genus.

IDENTIFICATION OF THE GLOCHIDIA OF FRESH-WATER MUSSELS

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Appendix V to the Report of the U. S. Commissioner of Fisheries for 1914

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IDENTIFICATION OF THE GLOCHIDIA OF FRESH-WATER MUSSELS.

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In investigations with reference to the natural hosts of our fresh-water mussels, the identification of certain larval forms at times becomes one of extreme difficulty, owing to the close resemblance of certain species one to another. Fortunately, so far as known, the glochidial shell is retained intact, even after metamorphosis in many instances, so that if the observer knows the glochidium, its form, size, and peculiarities, the identification is somewhat simplified, even though the marginal growth of the infant mussel shell is greatly increased in size and the shape modified. Believing that much useless experimentation could be avoided by the discovery of the natural hosts of the various species, much time has been devoted to this end, but at the same time it has not been forgotten that the first requisite is a collection of the glochidia of the various species found in the region worked over. The accumulation of such a collection presents difficulties, as the breeding seasons of certain forms have long been unknown, particularly of the rarer forms. The staff of the Fairport Biological Laboratory have kept this important object in mind, and, while conducting field work in various parts of the Mississippi Valley, have from time to time sent in glochidia of those species found in the vicinity of Fairport so rarely as to elude us at the proper season, and in addition an occasional species not native to our local waters. It has therefore been possible, since the publication of my former paper on the glochidia,[a] practically to complete the collection of local forms, the only desiderata now being *Lampsilis leptodon* and *Truncilla triquetra,* both of which are extremely rare in the Mississippi in this vicinity. The former, in fact, is a rather rare shell wherever found.

In the paper before referred to I gave an analytical key for identification of the glochidia figured. This is not attempted in the present instance, as the species are so few it is thought that descriptions and figures will suffice. These descriptions show, by comparison, the relationship with other forms so far as size and general characters are concerned. If the reader so desires, however, the position of the forms here described can easily be determined and placed in proper sequence in the key. The present method of describing conforms to that used previously, this paper being intended, in fact, to supplement the former one.[a] Any information to be of practical use must be available to all investigators, and in the present state of our knowledge of mussel culture the sooner it is made accessible the better; hence the appearance of these papers from time to time.

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[a] Surber, Thaddeus: Identification of the glochidia of fresh-water mussels. Bureau of Fisheries Document no. 771, 10 p., 3 pl. (47 fig.), 1912.

In the preparation of material no changes have been made in the technique, except that it has been found advisable to stain exclusively with alcoholic cochineal (Mayer's old formula).[b] Light, it has been found, plays an important part in the subsequent value of the material—strong light, particularly sunlight, bleaching out the glochidium till its transparency becomes such as to render it worthless. For this reason all material, both glochidia and natural infections of same, as soon as killed should be stored in a light-tight receptacle of some kind and there retained till stained and mounted.

In the descriptions to follow no attempt has been made to arrange the species systematically, an alphabetical arrangement being considered preferable.

Anodonta suborbiculata Say. [Fig. 1.]

Lake Contrary, St. Joseph, Mo., February 20, 1913. Collected by W. I. Utterback; collection of United States Biological Laboratory, no. G–72.

Glochidium of *Anodonta* type, large, subtriangular in shape, with spine at tip of each valve; hinge line straight, long; length slightly greater than depth, 0.325 by 0.320 mm. In general outline *suborbiculata* closely resembles *Anodonta grandis* but may be distinguished by its smaller size.

Thanks are due Prof. Utterback for his kindness in forwarding these glochidia for the station collection. In the vicinity of Fairport this species has apparently become extinct in its usual haunts, because of the unusually dry summer of 1911. During that season all the ponds dried up and many dead shells of this species were taken from the dry pond bottoms by Mr. H. Walton Clark and the writer. Host unknown.

Lampsilis breviculus brittsi Simpson. [Fig. 14.]

Niangua River, Hahatonka, Mo., August 7, 1913. Collected by W. I. Utterback; collection of United States Biological Laboratory, no. G–74.

Lampsilis type; semielliptical; ventral margin rounded; hinge line rather short, nearly straight; general outline of shell constricted at either end below hinge line; size large, 0.230 by 0.290 mm.

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[a] Surber, op. cit.

[b] Lee, Arthur Bolles: The microtomist's vade-mecum. Sixth edition, p. 175. London, 1905.

This glochidium is identical in size with *multiradiata*, but the hinge line is straighter, and the constriction of the outline below hinge, at either side, is characteristic. Compared with *Q. pustulosa*, with which it agrees in size, the hinge line is much longer than in that species while the outline in *pustulosa* below the hinge line is straight. Host unknown.

Lampsilis lienosa unicostata B. H. Wright. [Fig. 15.]

White River, Clarendon, Ark., October 20, 1913. Collected by W. B. Gorham; collection of United States Biological Laboratory, no. G–75.

Semielliptical in shape; short in proportion to depth; ventral margin rounded; hinge line long and but slightly curved; size medium, 0.185 by 0.240 mm.

In general outline this glochidium is of the type represented by *Lampsilis trabalis* and *Oboraria circulus*, being intermediate in size between these two species, but probably nearer *trabalis* in form, particularly in the rather obliquely rounded posterior margin. Host unknown.

Lampsilis multiradiata Lea. [Fig. 2.]

Auglaize River, Defiance, Ohio, July 22, 1913. Collected by H. Walton Clark; collection of United States Biological Laboratory, no. G–70.

Lampsilis type; semielliptical; ventral margin rounded; hinge line short and evenly curved; size large, 0.230 by 0.290 mm.

But for the much longer hinge line and larger adductor this could hardly be distinguished from average examples of *Quadrula pustulosa*, as it agrees in size with that form. Host unknown.

Lampsilis parva Barnes. [Fig. 3.]

Pond near Tulsa, Okla., July 20, 1911. Collected by F. B. Isely; collection of United States Biological Laboratory, no. G–67.

Glochidium semielliptical; ventral margin rounded; hinge line moderately short and evenly curved; size medium, 0.170 by 0.200 mm.

In general outline this glochidium strongly suggests that of *L. ligamentina*, from which it differs in being much smaller and in having a differently shaped adductor; in size it approaches nearest *Q. metanevra*, which has a short hinge line, and *L. anodontoides*, in which the hinge line is slightly depressed. Host unknown.

Lampsilis picta Lea. [Fig. 4.]

Cumberland River, Burnside, Ky., July 14, 1911. Collected by H. Walton Clark; collection of United States Biological Laboratory, no. G–64.

Glochidium semielliptical; ventral margin rounded; hinge line short, slightly curved, and faintly undulate; size large, 0.240 by 0.300 mm.

If we except the shape and size of the adductor this glochidium is almost identical with that of *L. iris*, both in outline and size. The specimen of *iris* used for comparison with this, and from which my figure of that species was drawn,[a] came from the Yellow River, Ind. If the character of the glochidium is a factor in the classification of the Unionidæ, and I believe it is, then the separation of *picta* and *iris*, even subspecifically, is difficult. Adult shells of *picta* from the Cumberland River and *iris* from Yellow River seem to differ, but it might be interesting to compare them with a series from an intermediate locality, like the Ohio River, for instance. Host unknown.

Lampsilis purpurata Lamarck. [Fig. 5, 5*a*.]

Cache River, near Clarendon, Ark., January 15, 1913. Collected by Thaddeus Surber; collection of United States Biological Laboratory, no. G–60.

Proptera type; axe-head shape; with two spines, one at each of the ventral corners of the shell; size large, 0.200 by 0.360 mm.

Though slightly smaller than *alata*, this species is almost identical in shape, except that it has a decidedly more curved ventral margin and better developed hooks. All the members of the axe-head group, so far as known, undergo wonderful changes while passing through their metamorphosis and this species is no exception, the growth of the infant mussel, while parasitic, being as great as *lævissima*.

Host: The specific host of this mussel is apparently the sheepshead (*Aplodinotus grunniens*), on which it occurs as a gill parasite. During January (12th to 16th), 1913, the writer secured five infected fish in the Cache River, Ark., the number borne by each fish being, approximately, as follows: 512, 172, 68, 192, and 500, in various stages of development. One fish bore a single glochidium on the ventral fin, probably more or less accidental.

Lampsilis ventricosa satura Lea. [Fig. 6.]

White River, Newport, Ark., November 16, 1912. Collected by W. H. Thomas; collection of United States Biological Laboratory, no. G–55.

Glochidium semielliptical in shape; ventral margin rounded; hinge line rather oblique; size medium, 0.205 by 0.245 mm.

Closely resembles *ventricosa typicus*, from which it differs only in the oblique hinge line and in having proportionately less depth, the depth of shell being about one one-hundredth of a millimeter less than in *ventricosa*. Host unknown.

Margaritana monodonta Say. [Fig. 7.]

Mississippi River, near Moline, Ill., May 2, 1913. Collected by Arthur D. Howard; collection of United States Biological Laboratory, no. G–68.

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[a] Surber, op. cit., fig. 46, pl. III.

Semielliptical in shape; ventral margin somewhat acutely rounded; hinge line long, straight; size extremely small, 0.050 by 0.052 mm.

This minute glochidium suggests *Tritogonia tuberculata* in general shape but has less proportionate depth, with longer hinge line. Host unknown.

Obovaria circulus Lea. [Fig. 8.]

Wabash River, Vincennes, Ind., June 9, 1913. Collected by Ernest Danglade; collection of United States Biological Laboratory, no. G–69.

Semielliptical in shape; ventral margin rounded; hinge line long and slightly depressed near center; size medium, 0.170 by 0.215 mm.

This glochidium is apparently intermediate in form between *retusa* and *ellipsis*, but rather nearer the latter, yet it differs from both in being of smaller size. In *ellipsis* the hinge line is straight, while in *retusa* the same line is undulated. Host unknown.

Quadrula coccinea Conrad. [Fig. 9.]

St. Joe River, Fort Wayne, Ind., June, 1913. Collected by H. Walton Clark; collection of United States Biological Laboratory, no. G–71.

Semicircular in shape; ventral margin rounded, somewhat oblique; hinge line long and straight; size medium, 0.160 by 0.160 mm.

This glochidium is of the type represented by *ebena*, *plicata*, etc., and very closely resembles *solida*, with which it agrees in size but differs in the obliquely rounded ventral margin. As a parasite it would be difficult to distinguish from *solida*. Host unknown.

Quadrula heros Say. [Fig. 10.]

Mississippi River, Moline, Ill., September 24, 1912. Collected by Arthur D. Howard; collection of United States Biological Laboratory, no. G–51.

Semielliptical in shape; ventral margin obliquely rounded; hinge line long, undulated, oblique; size large, 0.260 by 0.340 mm.

This glochidium is subject to more variation than any other with which I am familiar. For instance, some specimens from Caddo Lake, Tex., collected by Mr. Austin F. Shira, who has kindly allowed me to study his material, are uniformly shorter and more oval in outline, with hinge line less oblique, than specimens from the Ohio and Mississippi Rivers, and the variation in size is remarkable, the extremes being 0.300 by 0.340 and 0.250 by 0.262 mm. Another example, from White River, Ark., measures 0.280 by 0.380 mm. Notwithstanding its great variation in size, and even outline, this species can not readily be confused with any other, even though the larval gland may have been absorbed, which occurs during metamorphosis. This coiled gland is a prominent feature in the mature glochidium, as will be noted by reference to the figure (fig. 10), where it is shown without undue amplification.

Host: In Arkansas, last January (1913), I found this species parasitic in considerable numbers on the fins of the sheepshead (*Aplodinotus grunniens*) but none were present on the gills of the same fish. Thus we are forced to conclude it is a fin parasite, notwithstanding the fact that a specimen of eel (*A. chrysipa*) taken at the same place—Cache River, near Clarendon, Ark.—held a single glochidium on its gills, and a "water dog" (*Necturus maculosus*) also held one on the gills. The structure of the gills of the *Necturus maculosus* resembles the fin structure of fishes and may function the same, so it may not be at all remarkable to find mussel larvæ infecting them, at least of those species which take externally on fishes.

Quadrula lachrymosa Lea. [Fig. 11.]

Tributary of Fall River, Greenwood County, Kans., August, 1912. Collected by Kansas Biological Survey; collection of United States Biological Laboratory, no. G–63.

Glochidium (not fully matured) semielliptical in shape; ventral margin rounded; hinge line rather short, usually depressed, but sometimes straight; size small, 0.085 by 0.090 mm.

The shape of this glochidium is suggestive of *Tritogonia tuberculata*, but has a shorter hinge line and less depth; the size is practically the same, and with our present knowledge it might be possible to confuse the two species, especially when examined as parasites. Host unknown.

Quadrula obliqua Lamarck. [Fig. 12.]

Cumberland River, Burnside, Ky., July 14, 1911. Collected by H. Walton Clark; collection of United States Biological Laboratory, no. G–66.

Glochidium of the *trigona* type; semicircular; hinge line long and straight; depth greater than length; size medium, 0.160 by 0.175 mm.

This glochidium seems to be rather intermediate in shape between *Q. trigona* and *Unio gibbosa*, agreeing with the former in length, but with less depth, *trigona* being longer than deep, and *obliqua* deeper than long. While agreeing with *gibbosa* in shape, except somewhat longer hinge line, it is much smaller and is not likely to be confused with it. Host unknown.

Unio crassidens Lamarck. [Fig. 13.]

Cumberland River, Burnside, Ky., July 14, 1911. Collected by H. Walton Clark; collection of United States Biological Laboratory, no. G–65.

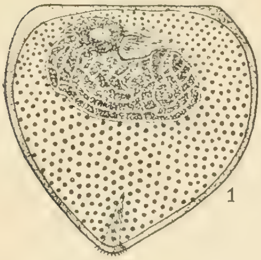
Glochidium subtriangular in shape; hinge line long and rather evenly curved; depth greater than length; size medium, 0.150 by 0.160 mm.

In this species the glochidium seems to be intermediate in shape between examples of the Anodonta group on the one hand and certain species of the *Lampsilis-Quadrula* group on the other, best represented in the former by *Alasmidonta calceola,* and in the latter by such species as *Quadrula ebena,* etc. Compared with *Unio gibbosa* it is more circular in outline, if we except the pointed ventral margin, and has a shorter, more curved hinge line. It is an aberrant type related to *Margaritana margaritifera.* Host unknown.

EXPLANATION OF FIGURES. (Plate I.)

Fig. 1. *Anodonta suborbiculata.*
Fig. 2. *Lampsilis multiradiata.*
Fig. 3. *Lampsilis parva.*
Fig. 4. *Lampsilis picta.*
Fig. 5, 5*a*. *Lampsilis purpurata.*
Fig. 6. *Lampsilis ventricosa satura.*
Fig. 7. *Margaritana monodonta.*
Fig. 8. *Obovaria circulus.*
Fig. 9. *Quadrula coccinea.*
Fig. 10. *Quadrula heros.*
Fig. 11. *Quadrula lachrymosa.*
Fig. 12. *Quadrula obliqua.*
Fig. 13. *Unio crassidens.*
Fig. 14. *Lampsilis breviculus brittsi.*
Fig. 15. *Lampsilis lienosa unicostata.*

PLATE I.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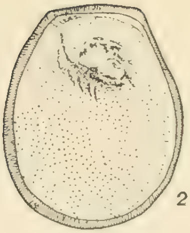
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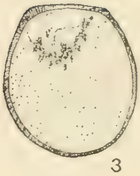
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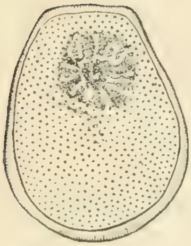
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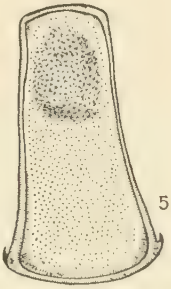
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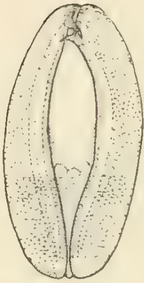
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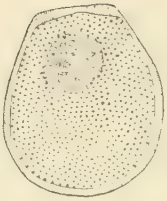
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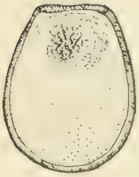
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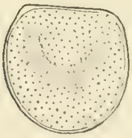
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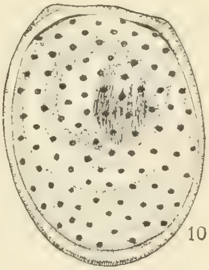
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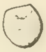
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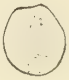
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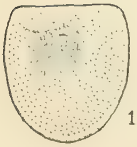
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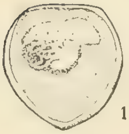
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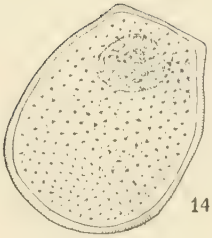
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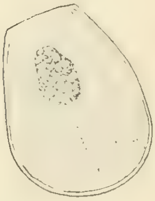
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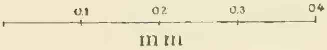

OTTER-TRAWL FISHERY

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U. S. Bureau of Fisheries

Appendix VI to the Report of the U. S. Commissioner
of Fisheries for 1914

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COMMUNICATION FROM THE COMMISSIONER OF FISHERIES TO THE SECRETARY OF COMMERCE, TRANSMITTING A REPORT ON THE OTTER-TRAWL FISHERY AND MAKING RECOMMENDATIONS REGARDING THAT FISHERY.

Department of Commerce,
Bureau of Fisheries,
Washington, January 20, 1915.

The Secretary of Commerce:

There is forwarded herewith, for transmission to Congress, a report embodying the results of an investigation by the Bureau of Fisheries of the method of fishing known as otter trawling. The investigation was undertaken, and this report thereon is submitted, pursuant to the authority contained in the act approved August 24, 1912, making appropriations for sundry-civil expenses of the Government for the fiscal year ending June 30, 1913, as follows:

> To enable the Commissioner of Fisheries to investigate the method of fishing known as beam or otter trawling and to report to Congress whether or not this method of fishing is destructive to the fish species or is otherwise harmful or undesirable, $5,000, or so much thereof as may be necessary.

A similar provision was contained in the sundry civil appropriation act for the following year, the sum voted being for the completion of the investigation.

In anticipation of the foregoing action by Congress, preliminary inquiries were begun on otter trawlers operating out of Boston in June, 1912. On September 30, 1912, Mr. A. B. Alexander, assistant in charge of the division of statistics and methods of the fisheries, was ordered to proceed to Boston and other places to determine on methods for prosecuting the inquiry, but it was not until December 28, 1912, that he was given definite authority to proceed with the work. Mr. Alexander had exclusive charge of the field investigations, with headquarters in Boston, and, with the exception of insignificant intervals, was continuously in the field during the calendar year 1913; and he is responsible for the methods followed and the data collected.

Under the plan of investigation adopted, men in the employ of the Bureau were placed on a number of the vessels, both otter trawlers and trawl liners, to make personal observations and records of the practices of the fisheries and the character of the catch. To each man there were issued the following instructions and schedule of the salient points at issue:

INSTRUCTIONS FOR OTTER-TRAWL INVESTIGATIONS.

The general purpose of the investigation is to determine the efficiency of the apparatus employed and its effects upon the fishes and the fishery.

The principal points to be considered are as follows:

1. The defining of each separate fishing area over which the trawl was worked. If within sight of land, giving the bearing of the nearest point of land and the distance from shore. If out of sight of land, giving the name of the fishing bank, and, if possible, the latitude and longitude.
2. The days and dates trawling was carried on.
3. The number of times the trawl was lifted each day.
4. The length of time the trawl was down on each occasion before lifting.
5. The speed of the vessel when trawling.
6. The weather conditions each day.
7. The kinds of fish taken from the net after each haul.
8. The quantity of fish, including shellfish, taken in each haul, showing the quantity of each kind and its proportion to the whole catch. (This should be ascertained by actual count or measurement, if possible. If this can not be done, then the closest possible approximation should be made.)
9. The quantity and kind of immature edible fish taken in each haul and the proportion of such to the whole.
10. What disposal was made of such immature fish, and what disposal was made of all nonedible fish taken.
11. The proportion of fish that were alive when each haul was brought on deck, and the kinds mostly found to be alive.
12. If immature and nonedible fish were thrown overboard, the percentage of each kind that were alive when returned to the sea and the percentage that would be likely to survive.
13. The size, up to which the various kinds of fish were regarded as immature and unmarketable by the captain of the trawler.
14. The number of times the trawl was worked over the same piece of ground in succession, showing whether the second or further drags were as successful as the first.
15. Whether fish eggs or spawn (except what might be emitted from the fish in the net by their own weight) were taken on any occasion, and if so, the kinds taken.
16. Whether fry of any fish were taken on any occasion, naming the kinds.
17. Whether ordinary fishing vessels at work were within sight on any occasion during trawling operation, and if so, giving the distance between such vessels and the trawler.
18. Whether any nets, lines, or other fishing gear were carried away or whether the fishing success of such gear was interfered with in any way by the presence of the trawler.
19. Details should be given showing the kinds of gear, where it was set, and the quantity damaged in each instance.

OTTER TRAWLERS.

Urgent representations have been made to this Bureau to the effect that the method of fishing known as otter trawling, which has been introduced on this side of the Atlantic only a few years ago, is such an unduly destructive method that if generally adopted the lines and other gear of ordinary fishing vessels will be continually carried away and destroyed and the fishing grounds quickly rendered nonproductive. The representations take the following form:

1. That the fishing areas where steam trawlers have already been operating have become seriously depleted of fish.

2. That the spawn or eggs of fish are destroyed by the trawlnet when being dragged along the bottom.

3. That immature fish are taken in very large numbers, which are killed in the process of capture and are thrown away.

4. That valuable shellfish are destroyed in large numbers.

5. That steam trawlers carry on operations at night as well as in the daytime, and that although an effort might be made to keep clear of the ordinary fisherman's gear during daylight, no such effort would be made in the darkness, owing to the invisibility of the buoys and other floating marks.

6. That it is not an uncommon thing for a steam trawler to come close to ordinary fishing vessels and their dories when the gear of the latter is in the water and being overhauled, and, if fish appear plentiful, to sweep around the spot and with the trawlnet carry away the gear with all the fish on the hooks.

7. Further, that while steam trawling has been prohibited within the territorial waters of Canada, such protection affords the inshore fisherman little protection, as their gear is frequently set even long distances beyond territorial waters, and it, of course, affords no protection whatever to the "bank" fishermen.

On the other hand it is urged:

1. That steam trawling is not an unduly destructive method of fishing, as an evidence of which is the fact that it has been intensively carried on in the North Sea and other European waters for very many years without any diminution of the fisheries being apparent.

2. That continuous supplies are necessary to meet the demands of the growing fresh-fish markets, and that as steam trawling can be carried on in practically all weathers, it is the only means of providing such continuous supplies.

3. That edible flat fishes, for which there is an evergrowing market, and which are taken in very limited quantities by hook and line, can be secured in large quantities by steam trawlers.

The men were supplied also with printed forms on which to record full data respecting the date, location, duration, and length of each haul; the numbers and sizes of each species of commercial fish taken; and the numbers and sizes of edible fish of species never, or not usually, placed on the markets. They were required to record, also, all observations of facts bearing on the points in dispute, the condition (living or dead) of the fish thrown overboard, the amount and character of the bottom material brought up in the trawls, any interference with or damage to trawl lines, etc.

The men making the observations on the vessels were:

W. W. Welsh, assistant, Bureau of Fisheries, Washington, D. C.
Thomas M. Douthart, Boston, Mass.
Frank S. Terry, New York, N. Y.
John H. Brennan, Port Clyde, Me.
John N. Burrows, Southport, Me.
Allan L. Black, McKinley, Me.
Walter H. Rich, Portland, Me.

In addition, Dr. W. C. Kendall, assistant, Bureau of Fisheries, made observations on the flounder otter-trawl fishery of Cape Cod in November and December, 1912; and Mr. E. C. Johnston, assistant, Bureau of Fisheries, investigated the paranzella-net fishery of San Francisco in September and October, 1912.

With the exception of Mr. Terry, who made but one trip, all of these observers had knowledge of the fisheries, although, with the exception of Mr. Burrows, who had fished on a line trawler out of Gloucester 15 years or more previously, none was or had been engaged in either the trawl-line or otter-trawl fisheries. An effort was made to obtain men capable of understanding and reporting on the matters which came under observation and at the same time as free as possible from prejudice by reason of their vocations and previous associations.

During June, 1912, the observers made three trips on otter-trawl vessels and recorded the data of 101 hauls of the nets. From January to December, 1913, 61 trips were made and 1,532 hauls were observed on otter trawlers; and from June to December, 1913, 17 trips and 90 sets of trawl lines were observed on schooners.

The field investigations were brought to a close in December, 1913, and on February 5, 1914, the Commissioner of Fisheries named for the consideration of the data and the preparation of a report a committee of three, of which Mr. A. B. Alexander was chairman and Messrs. H. F. Moore, assistant in charge of scientific inquiry, and W. C. Kendall, scientific assistant, were members. The orders under which this committee proceeded were as follows:

> You are hereby designated a committee charged with the duties hereinafter indicated in connection with the investigation of the American trawlnet fishery, as directed by Congress in the sundry civil appropriation act for 1913, as follows:
>
> "To enable the Commissioner of Fisheries to investigate the method of fishing known as beam or otter trawling and to report to Congress whether or not this method of fishing is destructive to the species or is otherwise harmful or undesirable, $5,000, or so much thereof as may be necessary."
>
> Your inquiries will involve, first, a thorough consideration and interpretation of the data collected by the Bureau of Fisheries regarding the steam trawlnet fishery of Boston and New York, the boat trawlnet fishery of New England, the paranzella fishery of California, and other similar fisheries in various parts of the United States, special attention being given to the detailed records obtained by agents of the Bureau while stationed continuously on trawling vessels during the years 1912 and 1913.
>
> For comparative purposes, you will naturally give consideration to the available data showing the present extent and general condition of the trawl fishery in Europe, and the steps that have been taken by the various European countries to regulate, restrict, or abolish the fishery; and the recent history of the fishery in Japan and Canada, and the action of those countries in regulating or abolishing the trawlnet fishery.

It is not my purpose in any way to influence the form and scope of your report, but I venture to suggest that your conclusions cover the following topics, which, with others, will doubtless occur to you:

(*a*) The general effects of the fishery on the permanency of the fish supply, and a comparison of the relative effects of the trawlnet and other forms of apparatus used in the same waters.

(*b*) The nature and extent of the destruction of young food fishes.

(*c*) The destruction or waste of edible fishes that have no present market value.

(*d*) The extent to which the trawlnet fishery of the United States has contributed to the food supply in fishes, not generally taken with other apparatus.

(*e*) Definite instances, supported by evidence, in which the scarcity of any kinds of fish on given grounds may be attributable to the trawlnet fishery.

(*f*) Interference of the trawlnet fishery with other fisheries.

(*g*) The necessity for international agreement with Canada, Newfoundland, France, and other countries in order to make effective any restrictive or prohibitory measures that may be determined to be desirable.

It is believed that in drawing your conclusions and making your recommendations you will be guided solely by the evidence afforded by the Bureau's investigations and by the action of other countries having prolonged experience with this method of fishery.

It is desired that the preparation of your report be expedited as much as possible, and that it be handed to me for administrative approval and submitted to Congress not later than April 15, 1914.

The report speaks for itself and no review thereof by me is necessary. I will simply refer to the chapters containing the conclusions and recommendations, and submit them as the official opinion of the bureau. While I was entirely unaware of the results of the inquiries until the completion and signing of the report, I have carefully reviewed the work of the committee, commend their labors, and indorse their findings as justified by the evidence.

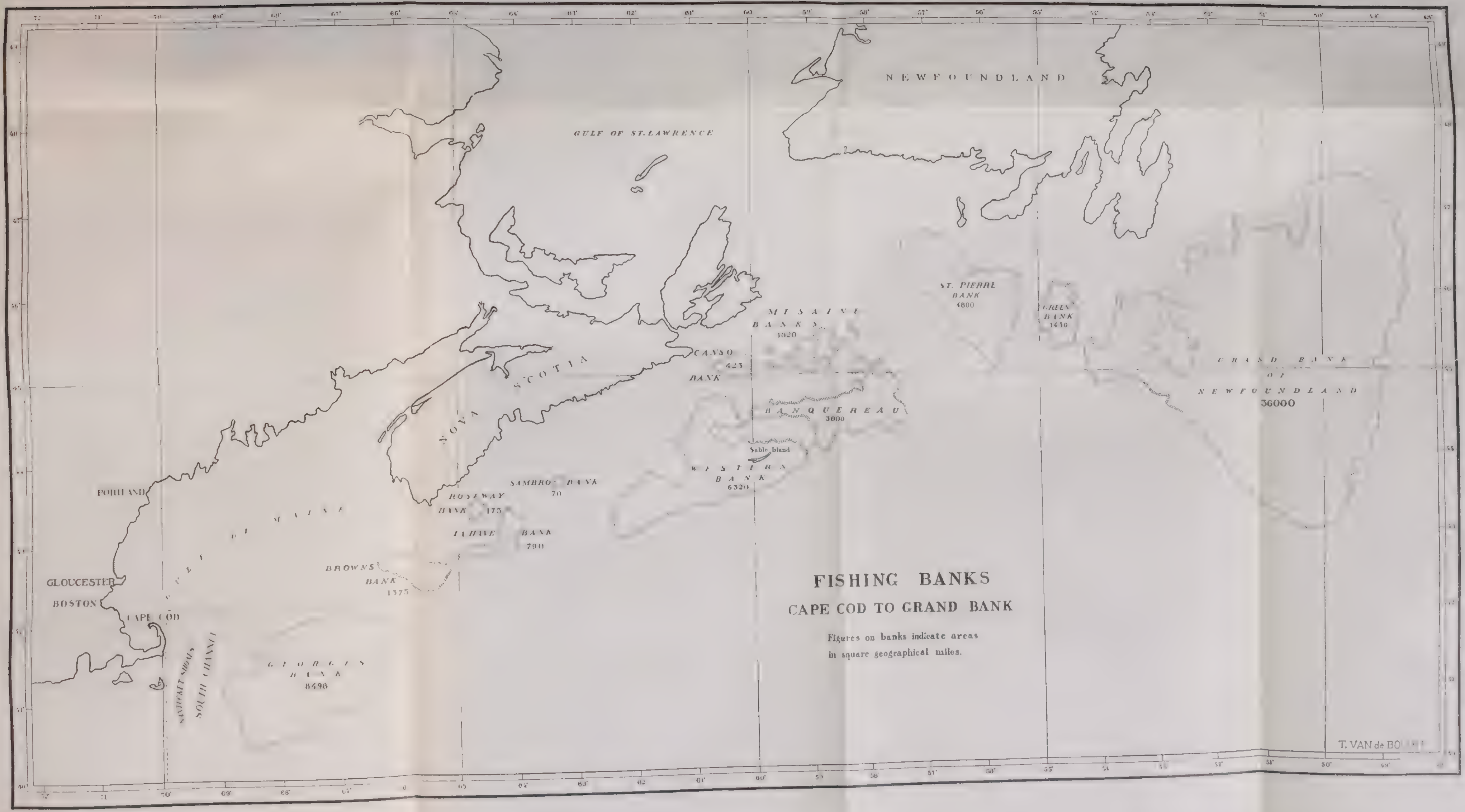
Respectfully,

H. M. SMITH, *Commissioner.*

HING BANK

OD TO GRAND B

res on banks indicate areas
quare geographical miles.



FISHING BANKS

CAPE COD TO GRAND BANK

Figures on banks indicate areas in square geographical miles.

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LETTER FROM BUREAU COMMITTEE TO THE COMMISSIONER OF FISHERIES TRANSMITTING REPORT ON THE OTTER-TRAWL FISHERY.

Department of Commerce,
Bureau of Fisheries,
Washington, January 6, 1915.

The Commissioner of Fisheries:

We are transmitting herewith our report on the effects of otter trawling on the fisheries, in accordance with your order of February 5, 1914, constituting us a committee for the consideration of the subject. We have been unable to comply with your injunction in regard to the time at which the report was to be rendered for the reason that we speedily found that the data acquired by the field investigations in 1913 were inadequate as a basis for conclusions which would be either just to all interests or commensurate with the importance of the subject. In order to reach any useful conclusions whatever it has been necessary to consider the available facts presented by the history of otter trawling in Great Britain, and we decided that for this purpose it was advisable to go to the original official sources of information rather than to utilize the conclusions arrived at by the various commissions which have investigated the subject, and this has consumed much time, particularly as the inquiry had to be conducted without interference with many other duties.

In reviewing the causes, conclusions, and results of various investigations of trawling in Great Britain, it must be borne in mind that the conditions of the sea fisheries there have always been and still are very different from those in this country. There trawling has undergone a progressive evolution, here it has just begun in a small way at the modern end of that evolution, both in the development of the engines of that method of fishing and the fishes sought.

Therefore the early considerations of the subject of trawling have only a general, if any, application to the question in this country, as the conditions, until recent date at least, are incomparable and a comparison, to be of much value, must be of synchronous and analogous conditions What was concluded by the Royal Commission of 1863, or any other commission or select committee, or the fact that 40 years ago or at any time prior to the advent of steam trawling, and particularly the otter trawl, a great scientist or other authority made this or that statement or came to this or that conclusion, affects the present question to the extent only that the statement or conclusion holds good at the present day and that it applies on this side of the Atlantic.

Although the present conditions in the fisheries of Great Britain have been reached through changes and progress of many years, and those of this country are of recent and comparatively sudden development, the "bones of contention" have apparently been handed along little changed through the various periods in Great Britain; and finally, still little changed, have crossed the Atlantic to America. When analyzed, the allegations against trawl fishing seem to have had their origin in that one economic factor that has been an ever-present cause of complaint against each and every innovation in fishery methods and appliances in whatever country—competition.

Therefore, most of the investigations and inquiries, while directly ascribable to localized self-interest, have been brought about by allegations mainly of general economic significance. The economic conditions, at least, changed from period to period, and each investigation had a somewhat different problem, and its conclusions and recommendations were in accordance with the evidence presented by the conditions of the time. Our investigations have the same characteristic, and it is not improbable that if we should be called on to conduct a similar inquiry in the future, we might find the conditions so changed as to require conclusions different from those we have now reached.

This committee has based its findings of fact and its conclusions, so far as the conditions on the banks visited by American fishermen are concerned, wholly on the mass of material that has been accumulated in the Bureau of Fisheries; and the opinions of persons other than the members of the committee have been rigorously excluded from consideration.

We are pleased to be able to report complete accord in our deductions and unanimity in our recommendations.

A. B. Alexander.
H. F. Moore.
W. C. Kendall.

REPORT ON THE OTTER-TRAWL FISHERY.

By A. B. Alexander, H. F. Moore, and W. C. Kendall.

INTRODUCTION.

Until 1905, American vessels fishing for demersal or bottom fish on the banks adjacent to the coast of the United States or on the more distant banks off the coast of Newfoundland and Canada confined themselves to the use of hand lines and trawl lines, the nature and methods of the use of which will be described later in this report. This fishery was, and is, conducted solely by sailing vessels. In the year mentioned, the steamer *Spray* was built at Quincy, Mass., for Boston owners, the Bay State Fishing Co. She was constructed on the general plans of British fishing steamers and was equipped for using the otter trawl, an entirely new method of fishing on the coast of the United States, also described further on in this report. In 1910, two more steam trawlers were built for the same owners, and in each of the years 1911 and 1913 three similar vessels were added to the fleet. In addition, a converted yacht owned in New York began fishing in 1912, and a small vessel owned in Gloucester sometimes uses an otter trawl. In the winter of 1914–15 a menhaden steamer entered the fishery. These, with the *Coquet*, a Scottish vessel which made several trips into New York, are the only vessels which have used otter trawls out of American ports or which have carried fares taken with otter trawls into such ports. The fishery has always been conducted predominantly out of Boston, and at present is practically confined to that place.

Although the merits and demerits of beam trawling and otter trawling, which are essentially similar, had long been the subject of much controversy and numerous investigations in Europe, there never had been occasion for either in the United States until the rapid augmentation of the Boston steam-trawling fleet after 1910 aroused the line fishermen to apprehension concerning the conservation of the fishing banks and a realization that they were face to face with a possible revolution in the methods of fishing.

As an outcome of this alarm, and in response to the appeal of the line fishermen and related fishery interests, the investigation on which this report is based was made.

THE AMERICAN BANK FISHERIES.

GENERAL CONSIDERATIONS.

In comparatively recent years the fishing fleet of the banks has undergone a great change in both model and rig. The introduction of a new class of vessels, having greater speed and superior seagoing qualities than were possessed by the old type, has made it possible to prosecute the fisheries on a larger scale at all seasons, especially during the winter months. In consequence of the increased size of the modern type of vessels, much more fishing gear is now operated per vessel than was customary 30 or 40 years ago. At that time fewer vessels, in proportion to the size of the fleet, were engaged in the market fishery—that is, landing their catch in a fresh condition—and more attention was paid to what is termed salt fishing—that is, the dressing and curing of fish on the banks where caught.

As the demand for fresh fish increased, more vessels became engaged in supplying the market, with the result that in a few years a large fleet was permanently employed in fishing for cod, haddock, and other species throughout the entire year. These vessels fish chiefly on Georges, Browns, and Western Banks, and in the South Channel, although at times many of the inshore grounds are visited. Quick trips are usually made, but there are times when a continuance of gales interrupts fishing for a week or more. Fish that are over two weeks old, as a rule, do not command the price that is realized for those more recently caught; in consequence there is an incentive for the fishermen to land their catch in as fresh condition as possible.

In the early years of the haddock fishery only a small portion of the haddock grounds were resorted to, but as more vessels were added to the fleet and competition arose the accessible grounds were more thoroughly exploited and larger catches resulted.

On Grand Bank, Western Bank, Quereau Bank, and other grounds where halibut were at one time very plentiful, there has, in recent years, been a decided falling off in the catch, and in some places where they were formerly found in abundance, it is no longer considered profitable to fish for them. This condition is thought to have been brought about by overfishing. Grounds that have been depleted in this manner require "rest"; and it has been found that localities which have been abandoned for a considerable length of time furnish a fairly good supply of halibut when again visited.

Taken as a whole, however, the halibut grounds of the western Atlantic are less productive than they were 15 years ago (1899), when the catch of fresh and salted halibut amounted to 9,025,182 pounds, compared with 3,379,580 pounds in 1914. In 1910 the catch was 4,023,999 pounds; in 1911, 3,501,745 pounds; in 1912, 3,511,539 pounds; in 1914, 3,379,580 pounds; the average annual yield in the past five years being 3,947,003 pounds.

The falling off in the amount of halibut landed in some years since 1899 may in a measure be accounted for by the fewer vessels engaged in the fishery, as it has been found unprofitable to send a large fleet of halibut catchers each season to banks where the results were extremely doubtful, especially in view of the fact that larger and more certain returns might be realized from the cod, haddock, or mackerel fisheries. Aside from changes mentioned in the halibut and haddock fisheries, the general condition of the various banks enumerated, with the exception of Georges and South Channel, remains about the same as it was 30 years ago.

In order to make a clear presentation of the underlying differences between the old line fisheries and the new trawlnet fisheries a full description of the respective apparatus and methods is desirable.

HAND-LINE AND TRAWL-LINE VESSELS.

Line trawls have been extensively used by the fishermen of New England for many years. This method of capture has largely supplanted hand lines, although in recent years, at certain periods, a considerable fleet of hand-liners has fished on Quereau Bank and Western Bank with marked success, fishing being carried on from the deck of some vessels and from the dories of others. The first class are known as deck hand-liners and the second as dory hand-liners. Each method is still used in the cod fishery, but trawl-line fishermen greatly outnumber those using hand-lines.

In the inshore fisheries, where formerly hand-lines were wholly used, trawl lines are now the principal means of capture, except on the local fishing grounds off Cape Ann, where gill nets have been extensively employed in the last three years for the capture of pollock, cod, and haddock.

Dory hand-line vessels.—A dory hand-line vessel usually carries from twelve to fourteen 13-foot dories. When not in use they are nested on the main deck, an equal number on each side. In this kind of fishing one man goes in a dory and operates two and three lines, the number being regulated by the depth of water, strength of tide, and other conditions.

Size of lines and leads.—The lines used by dory fishermen on Quereau and other banks, where this method of fishing is largely carried on at times, are tarred cotton, weighing from 8 to 10 pounds per dozen. The leads weigh from 2½ to 3½ pounds each. The depth of water in which fishing is carried on varies from 15 to 50 fathoms, while with trawl lines the depth is usually greater, 40 to 60 fathoms being a fair average.

Bait.—Salt clams, fresh squid, caplin, fresh herring, and other species are used for bait.

Skill of fishermen.—On good fishing ground a skillful fisherman will load his dory in a comparatively short time, and it is not uncommon, when fish are plentiful, for a boat to be loaded three or four times in a day's fishing. At such times, when there is a considerable fleet of vessels on the bank, the weather being pleasant, it is not unusual for 200 or 300 dories to be fishing side by side. In other localities where fish are less abundant the dories are likely to be more scattered. While the dories are out the skipper and cook generally fish from the deck of the vessel.

Time of fishing.—Generally the men go out in the dories twice each day; the first time being before sunrise and again just before noon. In the middle of the afternoon they return to the vessel and eat their supper, after which they begin to dress the catch.

The number of fish caught by each man is noted by the captain, and upon this record depends each man's share of the proceeds, it having been found that better results follow this system than on vessels where all fish are thrown together, all men sharing alike.

Fishing is continued each day, weather permitting, until a fare has been secured or a scarcity of fish compels the vessel to seek a new berth. Sometimes the voyage is interrupted by the necessity of leaving the bank for a fresh supply of bait.

Deck hand-line vessels.—Vessels of this class often fish on the same ground with dory hand-liners. The crew fish from the deck. The fishing gear is the same as that used in dories, excepting that the leads are heavier.

Trawl-line vessels.—Line trawlers engaged in the market fishery are of two classes, known as single and double dory fishermen, so called because of one man being required in the single and two men in the double dories. The dories are 12 and 14 feet long, respectively.

Number of dories and amount of gear.—Vessels that land fresh fish from offshore grounds, such as Georges, Browns, Cape Shore, and other banks, carry from 12 to 16 dories. Vessels fishing on local grounds are generally smaller in size and in consequence carry fewer dories.

Ordinarily each dory is furnished with from 4 to 6 tubs of trawl, each tub representing about 500 hooks, seldom exceeding 525 hooks. A flour barrel, sawed off above the lower quarter hoops, is used for a tub. The trawls are coiled in tubs as they are baited, the baited hooks being placed at the side in rows in such manner that they can be thrown out quickly without fouling. A vessel having 12 dories, each dory operating four tubs of trawl, would use 24,000 hooks to a set, and one having 16 dories 32,000 hooks. The number of tubs to be set is regulated by the abundance of fish, strength of the tide, and weather conditions. On first arriving on the bank it is frequently necessary to test the ground as to the abundance or scarcity of fish. At this time only a small portion of the gear is set, as it is not thought advisable to consume the bait on uncertain ground.

Cod and haddock trawl lines.—Trawl lines consist of two parts, the ground line and the gangings, together with buoys, buoy lines, and anchors. The ground line is a small, tarred cotton line weighing about 14 pounds per one dozen lines of 25 fathoms each. The size of lines varies somewhat. The gangings, to which the hooks are attached, are of tarred cotton line weighing about 5 pounds to 300 fathoms, are 2 feet long, and are fastened to the ground line at intervals of 5 feet, although some vessels employ gear with the hangings placed 38 inches apart, and others 5 feet 9 inches apart. There is no fixed rule governing the number of hooks on a trawl. Vessels engaged in the offshore fisheries generally use gear with the hooks closer together than those employed in fishing on local banks. Captains and crews of vessels entertain different ideas regarding the manner in which trawls should be rigged, and this in a measure accounts for the different styles of gear found on vessels engaged in the same fishery.

Trawls set for both cod and haddock are now rigged practically in the same manner. In past years, however, the hooks and gangings on cod trawls were somewhat larger than on haddock trawls. Smaller gear has gradually come into use, and the haddock trawl has taken the place of the cod trawl on Georges, South Channel, and shore grounds.

Dories and their outfit.—In making a passage to and from the banks and during stormy weather the dories are nested on the deck of the vessel and securely lashed. On arriving on that part of the bank where a set is to be made, the lashings are cast off and preparations made for fishing. Into the top dories of the nest, previous to hoisting out, the necessary fishing gear is placed, consisting of tubs of trawl, buoys, buoy lines, anchors, fish gaff, bait knife, and dory roller. It may be stated that the trawls are baited before being placed in the dories. The other dories are equipped in the same manner by their respective crews, and as soon as ready are hoisted over the side and paid astern, ready to set in the position selected by the captain.

Setting a trawl line.—In setting a trawl two men usually go in a dory, one to throw the trawl and the other to row the boat. Having arrived at the place where the set is to be made, they fasten a buoy to one end of the buoy line and throw it over the side. The buoy line is allowed to run out until the end is reached, when it, together with the upper end of the trawl line, is bent to the ring of the anchor. The anchor is lowered over the side, and the trawl is then thrown from the tub until the lower end is reached; it is then fastened to the upper end of the second tub of trawl, and so on until all of the tubs—four, six, or more—have been set. The last end of the trawl, together with the second buoy line, is bent to an anchor and thrown over the side, care being taken to prevent the buoy line from fouling with the hooks of the trawl as it runs out. To the free end of the buoy line is attached the second buoy. The distance between the buoys depends on the number of tubs set; sometimes it is a mile or more.

Hauling a trawl line.—At an early hour in the morning the men turn out to their breakfast, following which the dories are hoisted over the side and preparations are made for hauling. In this case the trawls have been left out overnight. There are many times, however, when two sets are made each day and no night fishing is done.

The men row in various directions according to the bearings of their outer buoys. Having reached the buoy, the man in the bow of a dory begins to haul the buoy line, hand-over-hand, over the roller inserted on the gunwale in the forward part of the dory. This is kept up until all the slack is taken in and a strain is brought to bear by the anchor and trawl, when the services of both men are required. The man in the stern unfastens the buoy and coils the buoy line. The anchor having been unbent and stowed away, the man in the bow commences to haul the trawl, which is coiled away in tubs by the man stationed aft, who at the same time takes the fish from the hooks. In this manner the entire "string" of gear is hauled, each section coiled in a tub, the hooks placed in such a position as to make it comparatively easy to rebait them. Before arriving alongside of the vessel everything connected with the trawl is stowed and fastened in such a manner that it can be removed from the dory to the deck without becoming tangled.

Underrunning a trawl.—This method permits the removal of the fish from the hooks and rebaiting them in a single operation, thus saving a considerable amount of labor. "Underrunning" is sometimes performed on ground where fish are plentiful and the weather is suitable for such operation. A trawl intended to be "underrun" is set in the usual manner with slight variation. A becket is made in the buoy line about 10 or 12 fathoms below the buoy. In the becket is bent a small line which reaches to the bottom, and to the bottom end of this line is fastened a stone weighing about 6 pounds. The ground line of the trawl, instead of being fastened to the ring of the anchor, is attached to the small line close to the stone. When thus set there is sufficient distance between the anchor on the buoy line and the stone on the small line to permit

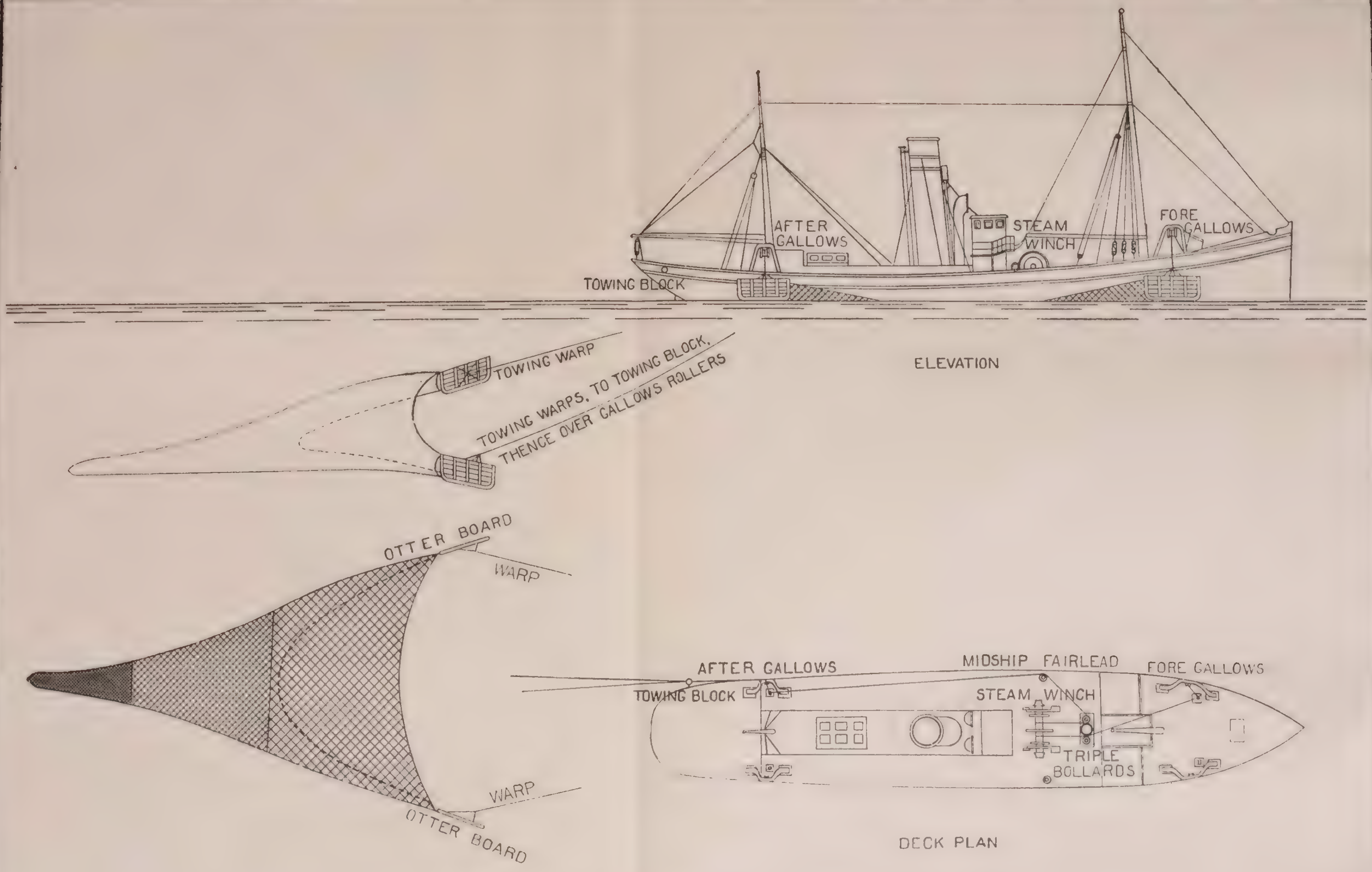

DIAGRAM OF STEAM TRAWLER
SHOWING FISHING GEAR

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of the trawl being lifted without disturbing the anchor. In hauling, the buoy line is pulled up until the small line running to the anchor is reached, the stone is hauled up and the end of the trawl is passed over the dory. One man unhooks the fish and the other baits the hooks. In this way the dory passes under the entire length of the trawl, the fish being taken from it and the hooks baited in a single operation. The object of operating trawls in the manner described is for the purpose of keeping them in one position during the time fish are plentiful.

OTTER-TRAWL VESSELS.

There are at the present time nine steam vessels regularly engaged in the otter-trawl fishery from American ports. These vessels were designed and constructed especially for this industry. There are also two other steam vessels employed in otter trawling, one a converted yacht, the other a menhaden vessel.

The typical steam otter trawler is a two-masted steel steamer, about 115 feet in length between perpendiculars, with a beam of 22 feet and a depth of 11 to 12 feet, and equipped with an engine of 450 indicated horsepower. The hull is strongly constructed, and shows sturdy, seaworthy lines, with considerable shear. Vessels of this class range in size from 248 to 296 gross tons, and are quite similar in the character and arrangement of their gear.

The forecastle deck is usually built up and covered in with a turtleback, forming a storeroom for fishing gear, and providing a breakwater which prevents the shipping of water over the bow. From here the deck is clear aft to the wheelhouse, which is situated about midships, over the fire room. From this point a low house runs aft in the center of the vessel, leaving a clear passage on both sides, and a considerable space of clear deck at the stern. A low bulwark extends entirely around the vessel.

Just forward of the wheelhouse stands the trawling winch, consisting of two drums, steam driven, on which are wound the two wire cables which operate the net. In front of the winch is a hatch leading to the fish hold.

The forward deck is divided by low, removable partitions, or "checkers," forming a series of pens of various sizes for the retention of fish during the operations of sorting and cleaning.

On each side of the vessel, fore and aft, stand the "gallows;" steel structures which support the sheaves through which the wire cables go outboard. These are usually in the form of an inverted U, inclined slightly outward. The forward pair stand slightly in advance of the foremast, and the after pair about abreast of the mainmast.

The otter trawl, as used by steamers fishing out of Boston, is essentially a large, flattened, conical bag, which is towed along the bottom of the sea. The mouth of this bag is kept open laterally by two large boards, or doors, one on each side, so rigged that they operate like kites. These boards are secured to the towing warps by chain bridles, so adjusted that as the trawl is towed along the resistance of the water causes the boards to pull away from each other, thus spreading the bag.

This conical bag is about 150 feet long. That portion of the mouth of the bag which lies on the sea bottom is secured to a foot line 140 feet long, reaching from board to board. The upper edge of the mouth is secured to a shorter headline, 110 feet long, also reaching from board to board. In operation this headline, being shorter, causes the top of the mouth of the bag to extend considerably in advance of the lower portion.

The otter boards are usually about 10 feet long, 4 feet high, and 2½ inches thick and are heavily shod and reinforced with iron. At ordinary towing speed their kite-like action extends the mouth of the net laterally to a width of from 70 to 90 feet. The flow of water into the net tends to keep it open vertically, but this force is assisted by a painted canvas float attached close to the center of the headline.

The foot line is a wire cable served with marline and wound with rope, giving it a diameter of about 4 inches. This wrapping tends to prevent the line from cutting into the bottom, and thus reduces the wear and tear on the net. Chafing gear, consisting of sections of old nets, is used for further protection.

The nets themselves, which are all imported, are constructed of strong manila twine, with a mesh of about 3 inches square in the forward third of the bag. The central third has a mesh about 1½ inches square. In the last third of the net, or cod end, the twine is doubled. This makes the knots larger and reduces the size of the mesh to about 1¼ inches square. The end of the cod end is open and is secured, while fishing, with a draw string.

In setting the trawl, the wire cables are run through fair leads to and through the gallow sheaves, one forward and one aft on the side from which it is proposed to set. The cables are then shackled to the chain bridles of the otter boards, which are in turn secured to either wing of the trawl. The vessel is then brought beam to the wind, the net being on the windward side. The cod end is then tied up and put overboard, the balance of the net being paid out as the vessel drifts to leeward away from it. The float (usually a balloon-shaped canvas bladder) is secured to the center of the top of the bag. The net is now all gone into the water, with the exception of the ends of the wings, which are attached to the otter boards hanging at the gallows.

Both towing warps are now slowly paid out for a short distance, and the vessel moves slowly ahead, turning toward the side from which the net is being set. This is continued until the otter boards have spread the net properly, and the whole apparatus has assumed the position for fishing. The cables are then paid out until the net has reached the bottom, when they are stopped and shackled together near the stern of the vessel.

The trawl is now towed slowly along the bottom at a rate of from 2 to 3 miles per hour, usually for about 1½ hours. Then the cables are released from the shackle at the stern, the winches are started, and as the net comes up the vessel is again brought broadside to the wind, with the net to the windward, and stopped. The otter boards are brought right up to the gallows blocks, and the net is further brought in by quarter lines run to the gypsy heads of the trawling winches, the crew taking in the slack of the net by hand. When the ends of the quarter lines are in, the foot rope of the net lies close alongside the vessel.

The remainder of the net is taken in over the side by hand until the cod end, which contains the catch, is reached. The throat of the cod end is now folded over and bunched together; a sling is passed around it, to which is attached a fall from the derrick boom on the foremast. A winch now hoists the cod end, with its contents, and swings it inboard, where it is lowered over one of the checkers. The draw string is now released, and the catch falls out onto the deck.

If fishing is to be continued in the same locality, the trawl is immediately again set as before, and the crew start at once to sort, clean, and stow the marketable fish and dispose of the trash. This work is accomplished in the following manner:

Two or more men, armed with pitchforks, attack the pile of fish in the checker, heaving overboard the skates, dogfish, monkfish, and other species considered worthless, and tossing the haddock, cod, and other marketable fishes into separate checkers. Here these fish (excepting the flat fish), are immediately cut and gutted, a stream of salt water from a hose washing away the blood and gurry. The livers of the cod, haddock, etc., are usually saved. The gutted fish are now forked into a bin where they are further washed by a stream of salt water. When this bin is full it is opened by means of a hinged bottom, and the fish fall into the hold, where a man is stationed who packs them away in pens with chopped ice. The flat fish are packed in ice without cutting or cleaning. The fish being stowed, the hose is turned onto the deck and the checkers cleaned in readiness for the next haul.

Fishing continues day and night The crew is divided into two watches, working six hours each. The average number of hauls per 24 hours, under ordinary circumstances, is about 10 to 12, although this will vary according to the nature of the ground, the amount of net mending necessary, and the weather. Including the passage to and from the fishing grounds, from four days to a week is usually required to get a full fare of fish.

FISHING BANKS OF WESTERN NORTH ATLANTIC.

The principal fishing banks of the western North Atlantic and their approximate areas, are as follows:

	Square miles.
Grand Bank	36,000
Green Bank	1,450
St. Pierre Bank	4,800
Quereau Bank	3,000
Misaine Bank	1,820
The Gully	1,200
Western Bank	6,320
Le Have Bank	790
Le Have Ridges	1,575
Roseway Bank	175
Browns Bank	1,375
Seal Island Ground [a]	1,250
Georges Bank	8,498
South Channel (about)	1,300
Total	69,553

Grand Bank.—The Grand Bank lies southeast of Newfoundland, and in area is about equal to all of the other offshore banks combined. It extends from latitude 42° 57′ to 47° 04′ N., and from longitude 48° 06′ to 54° 11′ W.

Its outline is that of an irregular triangle, with sides, respectively, 264, 225, and 264 miles long. In both area and extent of its fisheries the Grand Bank is the most important fishing ground in the world. Its principal fishery is that for cod, which is carried on by vessels from France, the United States, the Canadian Provinces, and Newfoundland. The fishing season lasts from April to October. Halibut also are taken in considerable numbers.

Green Bank.—Green Bank, situated between Grand Bank and St. Pierre Banks, is of comparatively little importance, although one of the best halibut grounds lies in the deep water near its southern part. Its length, north and south, is 62 miles, and its width is about 36 miles. Little is known of the abundance of cod on this bank, but vessels from Gloucester, Mass., fish here for halibut.

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[a] No name is given on the charts, but it is known to fishermen as the Seal Island Ground; it lies between Browns Bank and Seal Island.

St. Pierre Bank.—St. Pierre Bank is situated off the center of the southern coast of Newfoundland, and is distant about 10 miles from the islands of St. Pierre and Miquelon. Its length is about 125 miles, its width between 35 and 65 miles. Cod and halibut are the only food fishes found in considerable numbers, although a few cusk and haddock are sometimes taken. The season begins about the first of April and extends until November. Few except French cod vessels and fresh halibut fishermen resort at present to this bank, as other places offer better inducements.

Quereau Bank.—Quereau Bank is one of the most important of the northern banks. It is somewhat rectangular in shape, about 120 by 47 miles in extent, and lies between 44° 04′ and 45° 01′ north latitude, and 57° 10′ and 60° 05′ west longitude. Cod and halibut are the principal fish, but hake, haddock, and cusk also abound. The best season is from May to November, but halibut are found throughout the year off the edges of the bank.

Misaine Bank.—Misaine Bank lies north of the western two-thirds of Quereau Bank, from which it is separated by a channel about 20 miles wide. Its greatest length and width are 80 and 40 miles, respectively.

The Gully.—The Gully is the deep passage lying between Quereau Bank and Sable Island. It is an important place for halibut, the grounds proper being limited to that portion of The Gully between the meridians of 50° and 60° west longitude. Most of the vessels resorting to The Gully are from Gloucester, Mass.

Sable Island Bank or Western Bank.—This is one of the most important fishing grounds of the western Atlantic. It lies south of Cape Breton Island and the eastern part of Nova Scotia, between 42° 55′ and 44° 46′ north latitude and 59° 04′ and 82° 35′ west longitude, and is about 156 miles long and 76 miles wide. At its eastern end is Sable Island. Cod and halibut are the principal food fish taken, the former being most abundant from March to June. Vessels from all along the New England coast and the British Provinces resort to this bank for cod, but the halibut fishery is almost exclusively carried on by the Gloucester fleet.

Le Have Bank.—This bank lies between 42° 34′ to 43° 25′ north latitude, a distance of 52 miles, and 63° 50′ to 65° 07′ west longitude, a distance of about 54 miles. Cod and haddock are the principal species taken. These are found at all seasons of the year, but are most abundant during the early winter months.

Le Have Ridges.—Le Have Ridges is an eastern continuation of Le Have Bank, with a length of about 45 miles. Halibut, cod, and hake are the principal species taken.

Roseway Bank.—Roseway Bank lies north of the western part of Le Have Bank and southeast of Shelburne Light, Nova Scotia, and is of small extent, about 21 by 15 miles. Cod, haddock, and cusk are the principal fish taken, but hake, pollock, and halibut also occur. It is mainly resorted to by small vessels from Nova Scotia, although a few from New England occasionally fish there.

Browns Bank.—Browns Bank lies northeast of Georges Bank, from which it is separated by a gulley 15 miles wide. It is about 63 miles long by 43 miles wide. Cod, halibut, and haddock are the principal fish, but pollock and hake are also found. Cod and haddock are quite plentiful in winter.

Seal Island Ground.—Seal Island Ground is a direct continuation of the shore soundings, extending south nearly to Browns Bank, and northwest to about 35 miles beyond Seal Island. Cod, haddock, and pollock are the principal fishes, but halibut, cusk, and hake are also taken, and occasionally herring and mackerel. The fleet resorting there is composed chiefly of Nova Scotia vessels.

Georges Bank.—Georges Bank is the largest and most important ground near the coast of the United States and is second only to Grand Bank in these respects. It lies to the eastward of Cape Cod and Nantucket Shoals, between 40° 30′ to 42° 08′ north latitude and 66° to 69° west longitude. Its greatest dimensions are about 150 by 98 miles. On its western part are a number of dangerous shoals. During February, March, and April large schools of cod and haddock appear on this bank, usually on the "winter fishing grounds," whose area is about 11 square miles.

South Channel.—South Channel is practically an extension of Georges Bank, or that part of it lying west of 69° west longitude and between 40° 45′ and 41° 45′ north latitude and includes the ground covered by Nantucket Shoals and as far north as Chatham Lights. It is a very prolific ground for haddock and is resorted to by the Boston and Gloucester fleets. Its closeness to the markets makes it possible to land fresh fish in excellent condition.

COMPARISON OF THE CATCH BY OTTER-TRAWL AND TRAWL-LINE VESSELS.

The character of the catch, as measured by the number, and especially by the relative proportions of the species taken, varies with the time of year as well as with the apparatus employed, as will be seen from the following table, based on the records of observers stationed on both otter trawlers and line trawlers during the year 1913.

PERCENTAGE OF MARKETABLE AND UNMARKETABLE SPECIES OF FISHES TAKEN BY OTTER TRAWLS AND TRAWL LINES, RESPECTIVELY, IN 1913, ON CERTAIN VESSELS.

Species.	Otter trawls.		Trawl lines, June to December.
	January to May.	June to December.	
Marketable species, saved:	*Per cent.*	*Per cent.*	*Per cent.*
Cod	4.4	3.6	8.8
Haddock	70.3	36.6	35.6
Hake	.6	2.0	11.0
Pollock	.2	.3	.8
Cusk	....	(a)	2.6
Wolf fish	.1	(a)	(a)
Halibut	(a)	.1	.1
Sole	4.0	1.3	.1
Butterfish	....	.7	....
Rosefish	....	3.8	1.6
Lobster	(a)	(a)	....
Total marketed	79.6	48.4	60.6
Immature marketable species, wasted:			
Cod	.2	2.4	(a)
Haddock	9.1	22.3	.1
Hake	.9	15.2	7.5
Pollock	(a)	(a)	....
Halibut	.1	(a)	....
Sole	.2	....	....
Total	10.5	39.9	7.6
Nonmarketable species, wasted:			
Silver hake	.5	3.3	5.1
Flounders	4.0	2.7	1.3
Monkfish	.6	1.1	.5
Dogfish	2.4	2.8	21.2
Skate	2.3	1.8	3.5
Total	9.8	11.7	31.6
Total waste, all species	20.3	51.6	39.2

[a] Less than 0.1 per cent.

This is a record of the catch, not of the fares landed, and it includes the marketable, the unmarketably small of the marketable species, and the species which have no present market value. The question of the sizes of these fish will be considered later. All cod, haddock, hake, pollock, cusk, halibut, and sole of suitable size are saved, while wolf fish, butterfish, and rosefish are sometimes saved and sometimes thrown away. The "nonmarketable species" are all edible fish, but are not utilized in American markets.

It will be observed that there is but little change in the proportions of marketable and nonmarketable species taken by the otter trawls in the first and second halves of the year, respectively, but that during the period from June 1 to December 31 the trawl lines catch a much larger proportion of nonmarketable species than do the otter trawls, the difference being due to the larger number of dog-fishes taken on the lines, 21.2 per cent of the whole catch as compared with 2.8 per cent taken in the nets. During this period the otter trawls observed took 88.2 per cent of marketable species and the trawl lines 68.3 per cent, and of the nonmarketable species the nets took 11.7 per cent and the lines 31.7 per cent. Eliminating the dogfish, the proportion of total nonmarketable species taken by the two methods did not differ materially.

The waste of marketable species too small for sale was comparatively small in the otter-trawl fishery from January to May inclusive, not being materially higher than the catch of immature fish on lines in the latter half of the year, but from June to December, inclusive, the otter trawls were relatively almost five times as destructive of small fish as the lines.

On the vessels under observation the lines took no young cod and practically no young haddock, while 2.4 per cent of the whole catch of the otter trawlers consisted of young cod and 22.3 per cent of young haddock regarded as too small to sell. Stated in another form, 40 per cent of the cod and 38 per cent of the haddock taken by the otter trawlers from June to December were fish too small to market. From January to May but 3 per cent of the cod and 11 per cent of the haddock were unmarketable on account of their size.

The foregoing data are based on the entire catch of all vessels observed; since they cover trips to a number of banks and the returns for the two methods of fishing are not strictly comparable, for the steam trawlers and liners were in many cases not fishing on the same grounds, the following table has been prepared:

PERCENTAGE OF MARKETABLE AND UNMARKETABLE SPECIES OF FISHES TAKEN BY CERTAIN OTTER TRAWLERS ON GEORGES BANK AND SOUTH CHANNEL, RESPECTIVELY, AND BY LINE TRAWLERS IN SOUTH CHANNEL, FROM JUNE TO NOVEMBER, INCLUSIVE, 1913.

Species.	Otter trawls, June–November.		Trawl lines, June–November, South Channel.
	Georges Bank.	South Channel.	
Marketable species, saved:	*Per cent.*	*Per cent.*	*Per cent.*
Cod	3.7	3.7	7.8
Haddock	45.5	30.9	41.1
Hake	3.6	.8	9.6
Pollock	.2	.3	1.2
Cusk	(a)	(a)	2.3
Wolffish	(a)	(a)	(a)
Halibut	(a)	.1	.1
Sole	.8	1.6	(a)
Butterfish	1.0	.5	1.7
Rosefish	1.8	5.9	....
Lobster	(a)	(a)	....
Total marketed	56.6	43.8	63.8
Immature marketable species, wasted:			
Cod	2.0	2.7	(a)
Haddock	21.9	22.4	(a)
Hake	8.0	19.2	8.3
Pollock	(a)	(a)	....
Halibut	(a)	(a)	....
Sole	....	....	....
Total	31.9	44.3	8.3

(a) Less than 0.1 per cent.

PERCENTAGE OF MARKETABLE AND UNMARKETABLE SPECIES OF FISHES TAKEN BY CERTAIN OTTER TRAWLERS, ETC.—Continued.

Species.	Otter trawls, June-November.		Trawl lines, June-November, South Channel.
	Georges Bank.	South Channel.	
Nonmarketable species, wasted:	*Per cent.*	*Per cent.*	*Per cent.*
Silver hake	2.1	4.3	6.1
Flounders	2.0	3.4	.5
Monkfish	1.0	1.0	.3
Dogfish	4.4	1.7	18.0
Skate	2.0	1.6	3.0
Total	11.5	12.0	27.9
Total waste, all species	53.4	56.3	36.2

[a] Less than 0.1 per cent.

An analysis of this table shows considerable difference between the catches made by otter trawls on Georges Bank and South Channel during the same part of the year. The former ground produced a large proportion of merchantable species of fishes and a correspondingly small proportion of immature individuals. Again, considering the cod and haddock, it is found that the former ground relatively to the entire catch produced 3.7 per cent of marketable size and 2 per cent of immature fish and the latter 45.5 per cent and 21.9 per cent respectively of the two sizes. In other words, 35 per cent of all cod and 33 per cent of all haddock were too small to market.

In the South Channel fishery, 3.7 per cent of the whole catch consisted of marketable cod and 30.9 per cent of marketable haddock, while the young of these species constituted 2.7 per cent and 22.4 per cent, respectively. In the line fishery in South Channel, 7.8 per cent of the whole catch consisted of marketable cod and 41.1 per cent of marketable haddock, and there were practically no young of these species. While all of the cod and haddock taken on lines were marketable, but 67 per cent of the cod and 58 per cent of the haddock taken in the otter trawls were saved, the remaining 33 per cent and 42 per cent respectively being too small to sell. Summarizing, while the otter trawls were considerably less destructive to the young of marketable fishes on Georges Bank than in South Channel, they were in both cases incomparably more destructive than the lines fished in South Channel or on all of the other grounds collectively.

The young fish not large enough to market are thrown overboard from the vessels in the case of the otter trawlers and from the dories in the line fishery. The testimony of the observers on the vessels is that a very large percentage or practically all of the immature fishes of marketable species are dead when thrown over from the steamers, and the large percentages of young cod, haddock, and hake shown in the preceding tables are to be regarded as an absolute waste. The young fishes taken on the lines have a much better chance to live, as they have not been subjected to the pressure to which the netted fish are exposed and are immediately returned to the water, although some of them are killed or injured by being "slatted" against the sides of the dories.

In respect to the catch of unmarketable species there is not much difference if the dogfish be eliminated from consideration. All of the waste species enumerated in the table are edible and most of them are regarded with considerable favor in Europe. The dogfish has long been eaten and the demand for it in Great Britain is steadily increasing, but its only economic aspect in the United States is that of a nuisance to the fisheries. The monkfish is one of the most highly esteemed fishes in Germany, and the skate has wide consumption in various parts of the world. Both the flounder and the silver hake are good fishes.

WASTE FROM MARKETING SMALL FISHES.

The foregoing deals with the catch as a whole and the waste which results from the fish discarded as unmarketable. There remains to be considered such waste as may result from marketing an undue proportion of small fishes which, if permitted to live, would not only increase in size and thereby mechanically augment the volume of fish in the sea, but would further increase the supply by procreation. To develop the extent and character of such waste as may occur through the predominance of small fish in the catch the following tables are presented:

Weight and Percentage, by Culls or Sizes, of Cod, Haddock, and Hake Marketed by Otter Trawlers and Trawl Liners Fishing on all Banks in 1913.

Species and sizes.	Quantity.		Percentage.	
	Otter trawls.	Trawl lines.	Otter trawls.	Trawl lines.
Cod:	*Pounds.*	*Pounds.*		
Large	409,559	6,927,763	24.56	43.16
Market	1,119,975	8,099,221	67.15	50.46
Scrod	138,272	1,023,129	8.29	6.38
Total	1,667,806	16,050,113	100.00	100.00
Haddock:				
Large	10,366,002	30,265,920	83.00	6.31
Scrod	2,122,990	1,159,795	16.99	3.69
Total	12,488,992	31,425,715	99.99	100.00
Hake:				
Large	99,890	3,411,107	47.68	38.22
Medium	109,595	5,513,336	52.32	61.78
Total	209,485	8,924,443	100.00	100.00

The preceding table includes practically all of the cod, haddock, and hake marketed at Boston during the year, and it will be seen that not only, as has been previously shown, do the otter trawlers catch a larger proportion of the small fish than do the trawl liners, but the fish marketed are smaller in the cases of the cod and the haddock, although the reverse is true in respect to the hake. The regulations of the New England Fish Exchange at Boston prescribe the following weights of the several sizes in "culls" of these three species:

Cod:
- Large, 10 pounds and up.
- Market, over 2½ pounds to 10 pounds.
- Scrod, 1 pound to 2½ pounds, inclusive.

Haddock:
- Large, over 2½ pounds.
- Scrod, 1 pound to 2½ pounds, inclusive.

Hake:
- Large, 6 pounds and over.
- Medium, over 2½ pounds to 6 pounds.

We have at hand no data showing the average weights of the fishes of the several "culls," and the table presented can not be interpreted to show the economic loss due to the capture of a predominance of small fishes, even though they be marketed. Moreover, the table shows the catch from all banks, on many of which the otter trawlers fished but little or not at all. The only fishing ground for which there are sufficient data for a comparison of simultaneous fishing operations by both methods is South Channel, and the observed facts in respect to that locality are presented in the following table:

PERCENTAGES BY COUNT OF CULLS OR SIZES OF COD, HADDOCK, AND HAKE MARKETED BY OTTER TRAWLERS AND TRAWL LINERS, RESPECTIVELY, FISHING IN SOUTH CHANNEL FROM JUNE TO SEPTEMBER, 1913.

Species and sizes.	Otter trawlers.	Trawl liners.
Cod:		
Large	6.08	22.62
Market	71.50	69.15
Scrod	22.42	8.23
Total	100.00	100.00
Haddock:		
Large	71.81	82.16
Scrod	28.19	17.84
Total	100.00	100.00
Hake:		
Large	40.57	76.70
Medium	59.43	23.30
Total	100.00	100.00

This table differs from its predecessor in that the percentages are based on the number instead of the weight of the fishes marketed, and the loss resulting from the capture of an undue proportion of small fishes is more clearly brought out. One large cod, for instance, weighs at least four times as much as a scrod, yet each scrod taken is, barring accidents and enemies, a potential large cod. We have, however, no way of determining the age or weight "expectancy" of the average scrod, and any consideration of the probabilities would be mere unfounded speculation. It is clear, at least, that the otter trawl not only destroys more fish too small to market, but it is also more wasteful than the line fisheries by reason of the smaller average size of its marketable catch.

EDIBLE FISHES WASTED AND NEW KINDS MARKETED.

There is another type of waste which has not yet been considered. Failure to utilize a resource which from its nature is not imperishable is almost as economically indefensible as to needlessly destroy part of a product the other parts of which are utilized. Every edible or otherwise economically valuable fish left in the sea beyond the requirements of the maintenance of the species, or to serve as food for other species which are used, is a loss so long as the need of man for protein-bearing food remains unsatisfied. A waste of a recognized food species by any given method of fishing may become justifiable if large quantities of previously unutilized species, not possible to take by other apparatus, be made available to consumers. In final analysis the consumers' interest is paramount, and the real purpose of a fishery is that the people may have fish, both immediately and for all time.

The species of flounder locally known as "sole" is practically the only fish marketed by the otter trawlers which does not feature in the market returns of the trawl liners. These fish average about 3 pounds in weight. During the period from January to May, inclusive, 4 per cent, and from June to December, inclusive, 1.3 per cent by count, of all of the fish caught by otter trawls consisted of soles, all or practically all of which were marketed, while the quantity of this species caught on lines was negligible. During 1913 the trawlers marketed an average of about 50,000 pounds of sole per month, or 600,000 pounds per year. This is about three times the total quantity of marketable hake, 36 per cent of the saleable cod, and nearly 5 per cent of the haddock marketed from the same source. It is therefore a material addition to the food supply.

The average weight of the young cod, haddock, and hake killed and thrown away by the otter trawlers is not definitely known, but it is believed to be at least three-fourths of a pound. On this assumption, the total quantity of soles marketed by the otter trawlers is but one-third of the weight of small gadoids destroyed. As has been before pointed out, the catch of the young of these fish by trawl liners is comparatively negligible. Without considering the question of the potentiality for growth of these young fish and their value for the perpetuation of the fisheries, the quantity of them destroyed is not compensated for by the catch of sole.

The wolf fish or catfish is also taken more frequently in otter trawls than on the lines, but the entire quantity marketed by the trawlers did not exceed 75,000 or 80,000 pounds in 1913.

Of the edible though unutilized fishes taken by the two methods of fishing, the otter trawlers take more flounders and monkfish and the liners more silver hake and dogfish, while there is not much difference in the relative quantities of skates. Although several species of skates are highly regarded in other countries, it does not appear that any determined effort has been made to establish a market for such fishes in the United States. The relative prices of fishes are to a very large extent controlled by local taste, custom, and prejudice. For instance, the silver hake which is thrown away by American bank fishermen is the highest priced of the Irish demersal fishes (excepting flat fishes), the haddock being next in price. The skate sells in that country for but about 10 per cent less than the cod, and in England the fishermen receive for dogfish but 50 per cent less than for cod. In Germany the monkfish sells for much more than fresh mackerel. There is nothing to indicate, therefore, that the otter trawlers added greatly to the supply of fish food by the introduction in the markets of fishes which are not yielded in considerable quantities by the line fisheries, although their catch is such as to apparently make this to some extent possible.

FLUCTUATIONS IN THE CATCH AND EVIDENCES OF IMPOVERISHMENT OF THE FISHERY.

It is hardly to be expected that a fishery so recently established and of such moderate development as otter trawling in the United States would have any apparent effect on the abundance of fishes, but it has been alleged that a diminution of the catch of demersal fish already has become apparent, and it is necessary to examine the evidence in respect to the allegation. The statement made is that the beginning of the effects of otter trawling on the abundance of fishes on the banks became apparent during 1913 in the quantity of fish landed at Boston. The following table gives the landings at that port for a series of years:

Year.	Pounds.	Value.	Year.	Pounds.	Value.
1909	84,794,303	$2,225,383	1912	104,978,427	$2,718,304
1910	96,341,387	2,611,813	1913	92,317,920	2,869,472
1911	99,020,127	2,705,861	1914	92,252,880	2,622,919

This table shows that there was a gradual increase in the total catch from 1909, when there was but one otter-trawl vessel, until and including 1912, when there were six in commission, but that in 1913, when three more entered the fishery, there was a sudden fall in the quantity, though a slight increase in the value of the fish landed. In 1914 about the same quantity of fish was taken as in the preceding year.

This may be the result of the operation of any one or several of a number of factors, among which may be mentioned the condition of the markets for fish and labor, the weather, the natural irregularities of the migrations of the fishes themselves or an actual decrease in the fishes due to the fisheries or to natural causes. That the falling off in quantity was not due to a decrease in demand is indicated by the considerably higher price per pound brought by the fish in 1913 as compared with the preceding year.

That for several years there has been a deficiency of fishermen to man the schooners in the line fishery is well known. This is due partly to the introduction of gill netting in the fishery for cod and haddock, which withdrew a number of men from the line fisheries, and partly to the migration of a number of the fishermen to the Pacific coast. Also, a number of schooners have been sold to persons in Nova Scotia and elsewhere, and this, together with the paucity of men, has reduced the activity of the line fishery. From 1908 to 1914 the number of trips of line-caught fish landed at Boston fell from 4,493 to 3,089, a reduction of 31 per cent. To eliminate this factor as far as possible and to reduce the catch to a basis of a unit of effort expended in making it, tables and diagrams showing the fish landed at Boston for a period of years are presented.

QUANTITIES OF COD, HADDOCK, AND HAKE TAKEN ON ALL BANKS BY AMERICAN LINE VESSELS LANDING THEIR CATCH AT BOSTON AND GLOUCESTER, 1891 TO 1914, INCLUSIVE.

Year.	Number of trips.	Cod.		Haddock.		Hake.		All kinds.	
		Per trip.	Total.	Per trip.	Total.	Per trip.	Total.	Per trip.	Total.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
1891	4,119	4,043	16,655,200	8,220	33,860,197	2,997	12,347,730	15,261	62,863,127
1892 [a]									
1893	3,826	4,201	16,075,290	8,162	31,229,350	3,029	11,590,400	15,393	58,895,040
1894	4,537	4,780	21,687,330	8,706	39,502,450	3,275	14,863,100	16,762	76,052,880
1895	4,271	4,674	19,965,150	8,475	36,199,900	2,457	10,497,400	15,608	66,662,450
1896	4,187	4,836	20,251,160	6,904	28,909,200	1,560	6,535,300	13,302	55,695,660
1897	4,085	5,196	21,229,700	6,760	27,614,750	1,613	6,590,500	13,570	55,434,950
1898	3,491	4,263	14,882,500	6,235	21,769,300	2,114	7,382,430	12,613	44,034,230
1899	3,866	5,091	19,684,550	6,504	25,145,160	2,196	8,489,800	13,791	53,319,510
1900	3,731	4,748	17,717,650	7,567	28,235,850	1,853	6,917,100	14,170	52,870,600
1901	3,403	4,963	16,892,450	7,267	24,731,350	2,191	7,457,850	14,423	49,081,650
1902	3,981	5,836	23,233,900	8,575	34,138,850	2,065	8,223,850	16,477	65,596,600
1903	3,818	5,600	21,381,350	9,747	37,216,200	2,519	9,617,750	17,866	68,215,300
1904	4,056	4,605	18,678,525	10,087	40,916,300	2,775	11,258,100	17,468	70,852,925
1905	4,280	5,811	24,872,200	12,313	52,700,650	2,223	9,516,500	20,347	87,089,350
1906 [a]									
1907 [a]									
1908	4,493	6,258	28,119,400	8,518	38,272,500	2,761	12,419,500	17,540	78,811,400
1909	4,740	5,417	25,678,900	7,756	36,766,255	2,404	11,395,000	15,578	73,840,150
1910	4,487	5,744	25,777,210	9,364	42,016,820	3,644	16,353,100	18,753	84,147,130
1911	3,793	5,573	21,139,800	10,630	40,320,200	2,949	11,186,225	19,152	72,646,225
1912	3,381	6,347	21,460,350	11,774	39,810,500	3,335	11,276,050	21,457	72,546,900
1913	3,250	5,577	18,127,912	10,313	33,519,547	3,046	9,900,945	18,937	61,548,404
1914	3,089	6,527	20,163,129	10,349	31,970,866	2,327	7,190,065	19,204	59,324,060

[a] Data not available.

The preceding table and the following diagram based on it apply to the three most important food fishes of the banks—the cod, haddock, and hake—and reduce the catches for the several years enumerated to a common basis of the average yield per trip, which, within certain limits, may be considered as indicating the relative annual abundance of the fish in the regions frequented by the fishing fleets.

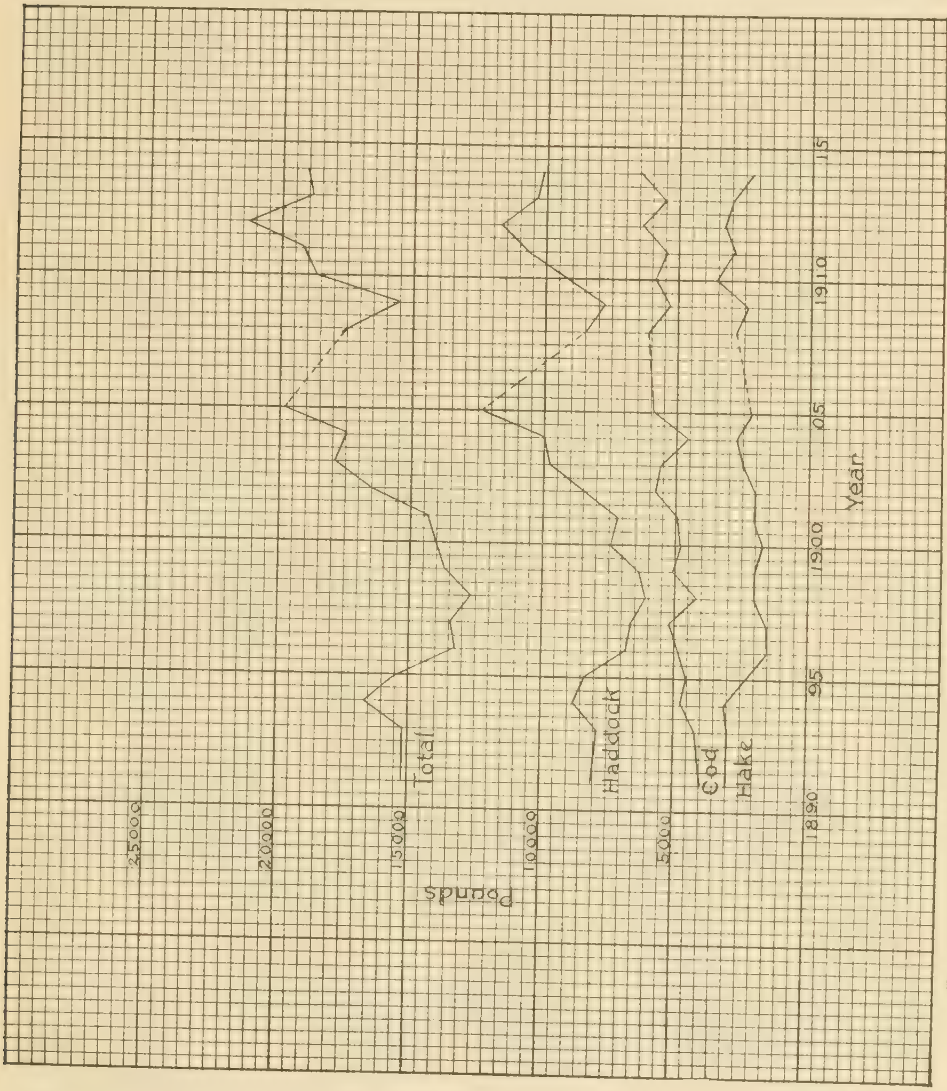


Diagram showing the catch per trip by American line vessels fishing on all banks.

The yield per trip of trawl liners fishing on all banks was less in 1914 than in 1912, but was equal to or more than in three of the five years immediately preceding, and this is true not only of the aggregate, but essentially true of each of the species named. There is, furthermore, a general upward trend of the catch per trip from about 1896 to the present time, and the average since 1910, when the steam-trawl fleet began to increase, has been higher than for any preceding like period since 1891. There is, therefore, no statistical evidence of a decrease on the fishing banks as a whole.

A majority of the trips represented in this table were made to banks on which the otter trawlers fish little or not at all, and the point may be raised that the destructive effects of the trawls might be masked by the returns of fish from distant banks which were not affected. To examine into this phase of the subject and to develop the locale of such diminution as may have occurred, the following tables and diagrams have been prepared:

QUANTITY OF COD, HADDOCK, AND HAKE TAKEN ON ALL GROUNDS EXCEPT GEORGES BANK, SOUTH CHANNEL, AND NANTUCKET SHOALS BY AMERICAN LINE VESSELS LANDING THEIR CATCH AT BOSTON AND GLOUCESTER, 1891 TO 1914, INCLUSIVE.

Year.	Number of trips.	Cod.		Haddock.		Hake.		All kinds.	
		Per trip.	Total.	Per trip.	Total.	Per trip.	Total.	Per trip.	Total.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
1891	2,909	2,882	8,384,200	5,034	14,643,997	4,060	11,812,605	11,976	34,840,802
1892 [a]									
1893	2,586	2,985	7,719,690	4,728	12,226,750	2,985	7,720,000	10,698	27,666,440
1894	3,130	3,473	10,873,430	4,792	14,999,350	2,911	9,113,200	11,177	34,985,980
1895	2,814	3,049	8,580,750	4,804	13,518,900	1,987	5,593,000	9,841	27,692,650
1896	2,691	2,861	7,701,260	4,018	10,813,900	1,128	3,035,600	8,008	21,550,760
1897	2,784	3,140	8,743,100	3,871	10,778,050	1,212	3,376,000	8,224	22,897,150
1898	2,545	2,612	6,649,900	3,536	9,000,150	1,435	3,652,230	7,584	19,302,280
1899	2,688	3,529	9,488,350	3,266	8,779,460	1,527	4,105,200	8,323	22,373,010
1900	2,540	3,478	8,835,650	4,144	10,526,650	1,247	3,168,500	8,870	22,530,800
1901	2,504	3,643	9,123,850	4,380	10,968,350	1,840	4,608,750	9,864	24,700,950
1902	2,520	4,006	10,095,650	4,734	11,931,850	1,312	3,307,950	10,053	25,335,400
1903	2,419	4,210	10,184,750	6,220	15,048,500	1,758	4,253,050	12,189	29,486,300
1904	2,461	2,958	7,281,225	5,170	12,725,700	2,218	5,459,900	10,348	25,466,825
1905	2,378	2,881	6,850,000	6,328	15,049,450	2,050	4,877,100	11,260	26,776,550
1906 [a]									
1907 [a]									
1908	2,988	3,398	10,155,000	5,313	15,875,400	2,059	6,151,500	10,770	32,181,900
1909	3,373	3,174	10,706,500	5,960	20,105,150	2,248	7,584,600	11,383	38,396,250
1910	3,126	3,364	10,516,100	5,630	17,599,550	3,871	12,102,300	12,865	40,217,950
1911	2,806	4,203	11,795,550	5,336	14,974,200	2,567	7,204,125	12,107	33,973,875
1912	2,209	4,406	9,733,950	6,545	14,459,300	2,943	6,502,650	13,896	30,695,900
1913	2,242	3,927	8,805,648	7,609	17,060,431	3,096	6,941,526	14,633	32,807,605
1914	2,153	6,469	13,929,217	6,460	13,909,607	2,760	5,944,051	15,691	33,782,875

[a] Data not available.

The otter trawls have been used almost exclusively on Georges Bank, South Channel, and Nantucket Shoals; and it will be seen that, excluding these grounds, the catch per trip of cod, haddock, and hake, collectively, by liners, has exhibited a gradual and almost uninterrupted increase from 1908 to 1914, the aggregate gain during that time being nearly 45 per cent. So far as the individual species were concerned, the catch of cod per trip in 1914 was larger than in any other year enumerated; the catch of haddock was larger than in any year, except 1912 and 1913, being much smaller than in 1913; and of hake about as many were caught as in any year, excepting 1891 and 1910.

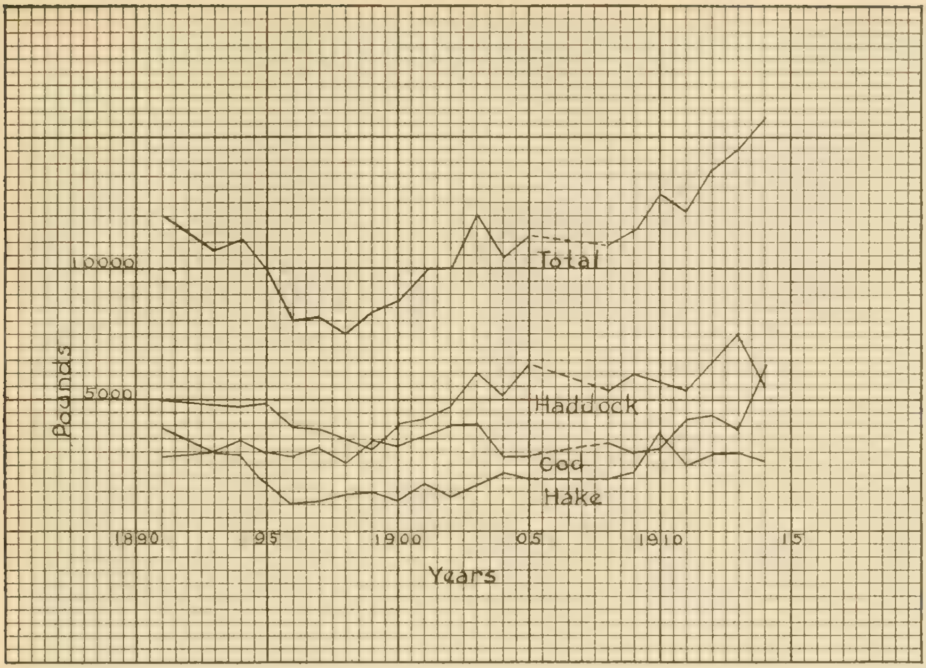


Diagram showing the catch per trip by American line vessels fishing on all grounds except Georges Bank, South Channel, and Nantucket Shoals.

QUANTITY OF COD, HADDOCK, AND HAKE TAKEN ON GEORGES BANK, SOUTH CHANNEL, AND NANTUCKET SHOALS, BY AMERICAN LINE VESSELS LANDING THEIR CATCH AT BOSTON AND GLOUCESTER, 1891 TO 1914, INCLUSIVE.

Year.	Number of trips.	Cod.		Haddock.		Hake.		All kinds.	
		Per trip.	Total.	Per trip.	Total.	Per trip.	Total.	Per trip.	Total.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
1891	1,210	6,835	8,271,000	15,881	19,216,200	442	535,125	23,158	28,022,325
1893[a]	1,240	6,738	8,355,600	15,324	19,002,600	3,121	3,870,400	25,184	31,228,600
1894	1,407	7,685	10,813,900	17,415	24,503,100	4,086	5,749,900	29,187	41,066,900
1895	1,457	7,813	11,384,400	15,566	22,681,000	3,366	4,904,400	26,746	38,969,800
1896	1,496	8,388	12,549,900	12,095	18,095,300	2,339	3,499,700	22,824	34,144,900
1897	1,301	9,597	12,486,600	12,941	16,836,700	2,470	3,214,500	25,009	32,537,800
1898	946	8,702	8,232,600	13,498	12,769,150	3,943	3,730,200	26,143	24,731,950
1899	1,178	8,655	10,196,200	13,892	16,365,700	3,722	4,384,600	26,270	30,946,500
1900	1,191	7,457	8,882,000	14,869	17,709,200	3,147	3,748,600	25,474	30,339,800
1901	899	8,641	7,768,600	15,309	13,763,000	3,169	2,849,100	27,119	24,380,700
1902	1,461	8,992	13,138,300	15,199	22,207,000	3,364	4,915,900	27,557	40,261,200
1903	1,399	8,003	11,196,600	15,845	22,167,700	3,834	5,364,700	27,683	38,729,000
1904	1,595	7,145	11,397,300	17,674	28,190,600	3,635	5,798,200	28,454	45,386,100
1905	1,902	9,475	18,022,200	19,795	37,651,200	2,439	4,639,400	31,709	60,312,800
1906	1,901	10,150	19,296,800	17,565	33,392,000	2,113	4,018,600	29,830	56,707,400
1907	1,674	11,256	18,843,500	12,966	21,706,600	2,271	3,801,900	26,494	44,352,000
1908	1,505	11,936	17,964,400	14,881	22,397,100	4,164	6,268,000	30,983	46,629,500
1909	1,367	10,952	14,972,400	12,188	16,661,100	2,787	3,810,400	25,928	35,443,900
1910	1,361	11,213	15,261,110	17,940	24,417,270	3,123	4,250,800	32,277	43,929,180
1911	987	9,467	9,344,250	25,679	25,346,000	4,034	3,982,100	39,181	38,672,350
1912	1,172	10,005	11,726,400	21,630	25,351,200	4,072	4,773,400	35,709	41,851,000
1913	1,008	9,248	9,322,264	16,328	16,459,116	2,935	2,959,419	28,512	28,740,799
1914	941	6,602	6,213,312	19,230	18,095,059	1,344	1,265,314	27,177	25,573,685

[a] Data not available for 1892.

Referring to the table showing the results of line fishing on Georges Bank, South Channel, and Nantucket Shoals, a different condition is apparent. There the total catch per trip was smaller than in any year since 1908, excepting 1909; the catch of cod was the lowest recorded; more haddock were caught than in any year, excepting 1905, 1911, and 1912; and fewer hake were taken than in any year since 1891.

An examination of the following table and diagram, exhibiting the catch of the otter trawls, shows that the catch per trip of the gadoid fishes as a whole in 1914 was about equal to that of 1913 and lower than for any other year, excepting 1908 and 1909. Fewer cod were taken in 1914 than in any year, excepting 1910; fewer haddock than in three of the preceding six years.

Quantities of Cod, Haddock, and Hake Taken by Otter Trawlers from Georges Bank and South Channel, 1908 to 1914, Inclusive.

Year.	Number of trips.	Cod.		Haddock.		Hake.		All kinds.	
		Per trip.	Total.	Per trip.	Total.	Per trip.	Total.	Per trip.	Total.
		Pounds.	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.
1908	44	4,767	209,800	35,045	1,542,000	1,059	46,600	40,872	1,798,400
1909	47	3,400	159,800	36,574	1,719,000	1,582	74,400	41,557	1,953,200
1910	59	2,133	125,850	47,033	2,775,000	789	46,600	49,956	2,947,450
1911	178	3,171	564,500	41,388	7,367,100	852	151,700	45,411	8,083,300
1912	295	6,620	1,952,950	43,954	12,966,700	355	105,500	50,932	15,025,150
1913	326	5,115	1,667,806	38,309	12,488,992	642	209,485	44,068	14,366,283
1914	387	2,970	1,149,595	39,750	15,383,550	670	259,913	43,392	16,793,058

There is ample evidence, therefore, that the catch of the principal food fishes on the banks frequented by the otter trawlers was considerably smaller in 1913 than for several years preceding, while on the banks on which there is little or no trawling there was a material increase, the catch on all banks combined being slightly above the average for the past six years. If the investigations had been made in 1911 or 1912, the statistical evidence would have tended to show an increase rather than a decrease during the same period in the average catch of fish by both otter trawls and lines on Georges Bank and South Channel.

In 1914, as compared with 1913, both liners and trawlers made smaller catches of cod per trip to Georges Bank, South Channel, and Nantucket Shoals and larger catches of haddock. On the other hand, the trips to all other banks yielded a smaller average catch of haddock and a larger catch of cod. If this can be held to mean anything, it is that during 1914 there were more haddock and fewer cod on the banks frequented by the trawlers and that the data indicate that there was merely a shifting of the schools of these fish from one region to another, the average on all banks combined remaining practically uniform.

The foregoing applies to that period only during which the steam trawlers have been a factor in the fishery, but the tables

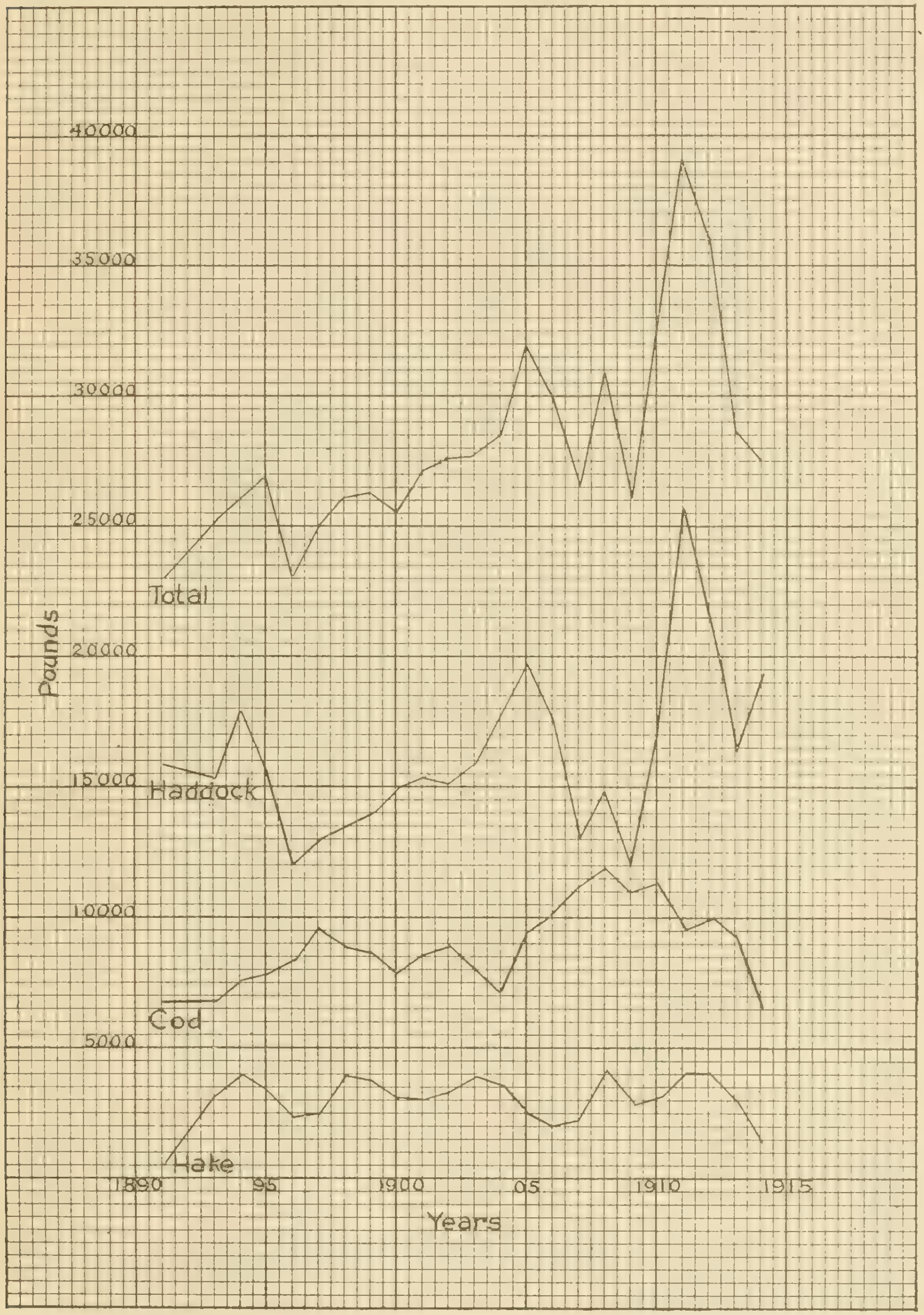
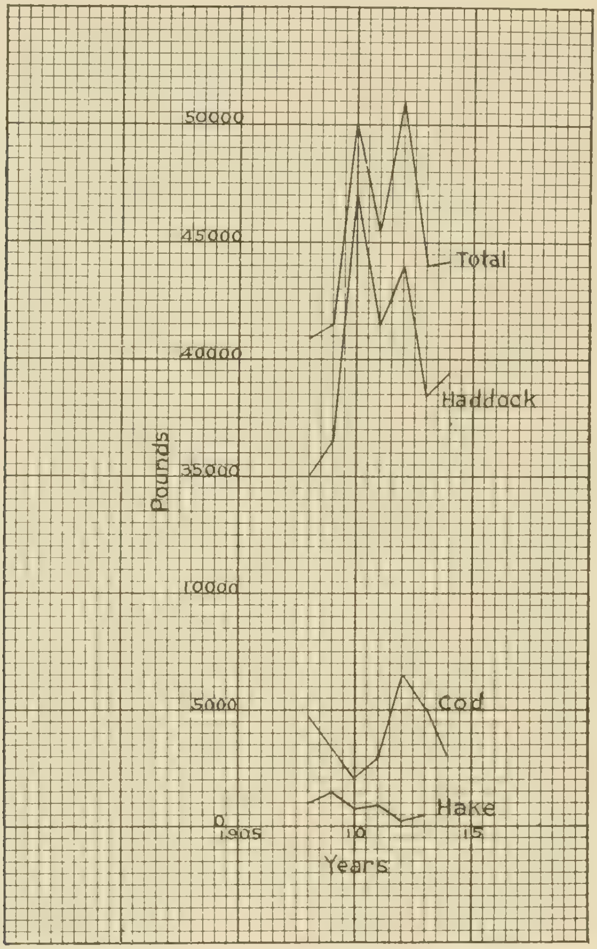


Diagram showing catch per trip by American line vessels fishing on Georges Bank, South Channel, and Nantucket Shoals.

and diagrams of the line-fishery catches supply almost complete data back to 1891. Considering this longer period, it will be seen that the average catch per trip fell rather sharply from 1891 to about 1896 to 1897, but that since those years there has been a net increase both on the banks fished by the steam trawlers and on those which are rarely or never so fished. The sharpest fluctuations, however, are shown on the banks and during the period covered by the otter-trawl fishery. On Georges Bank, South Channel, and Nantucket Shoals, the heaviest catch of haddock ever made as well as the lowest since 1896 occurred within this period, but the lowest catches per trip were when but one steam trawler was operating, and the largest and next to the largest came after the fleet had been considerably augmented.



Catch per trip by otter trawlers fishing principally on Georges Bank and South Channel.

After this report had been nearly completed, it was represented to the committee that during the year 1914 the fishery on Georges Bank, particularly for haddock, had been very unsatisfactory and that the line fisherman had practically ceased to resort to these grounds on that account. To test this allegation, the following tables and the diagrams based on them have been prepared, showing the total annual catches and the average catches per trip of Gloucester vessels for a period of years. Gloucester alone was considered because all vessels from that port are liners, while the Boston fleet comprises the otter trawlers, which have gradually increased in numbers and have made it more difficult, therefore, to present valid comparisons between the several years.

QUANTITIES OF COD, HADDOCK, AND HAKE TAKEN BY GLOUCESTER LINE FISHERMEN ON GEORGES BANK, 1905 TO 1914, INCLUSIVE.

Year.	Number of trips.	Cod.		Haddock.		Hake.		All kinds.	
		Per trip.	Total.	Per trip.	Total.	Per trip.	Total.	Per trip.	Total.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
1905	478	11,410	5,451,071	11,720	5,602,212	790	337,804	23,921	11,391,087
1906	418	15,215	6,359,900	21,377	8,935,735	1,495	625,091	38,088	15,920,726
1907	361	17,135	6,185,881	8,994	3,246,682	1,232	444,616	27,361	9,877,179
1908	316	22,930	7,246,011	11,860	3,747,820	646	203,998	35,436	11,197,829
1909	207	23,940	4,955,585	4,758	984,830	343	70,930	29,040	6,011,349
1910	187	28,516	5,332,487	8,255	1,543,775	441	82,493	37,212	6,958,755
1911	211	18,909	3,989,879	8,591	1,812,803	1,074	226,638	23,836	5,029,320
1912	268	20,306	5,441,802	12,606	3,378,439	610	163,607	33,522	8,983,848
1913	181	21,927	3,968,716	14,614	2,645,060	194	35,143	36,734	6,648,919
1914	123	19,679	2,420,597	21,305	2,620,525	552	67,919	41,536	5,109,041

From the tables and diagrams several facts appear. In the first place, since 1905 there has been a general large and fairly continuous decrease in the combined catch of the principal species and of the cod taken on Georges Bank by Gloucester vessels using lines. In the case of the haddock there was an enormous decrease from 1905 to 1909, but since then there has been a general increase in the total quantity landed at Gloucester.

Synchronously with these developments, there has been a heavy decrease in the number of trips, and this decrease was numerically greatest prior to 1909, when there was but one steam trawler in service. The falling off in the totals was, therefore, to some extent due to a reduction of fishing activity by the Gloucester vessels, and to eliminate this variable we have reduced the catch to a basis of quantity per trip and have found that the catch per trip of cod, haddock, and hake combined was greater in 1914 than in any year since 1905 at least and of haddock was about equal to that of 1906 and much greater than for any other year of the period considered. The catch of cod per trip was greater in 1914 than during four of the preceding nine years. The average catch per trip of cod and haddock each, and of these two combined with the hake, was greater for the five years 1910 to 1914, inclusive, than it was for the preceding five-year period.

We find, therefore, that there is no statistical support for the claim that the haddock, or any other demersal fish on Georges, has

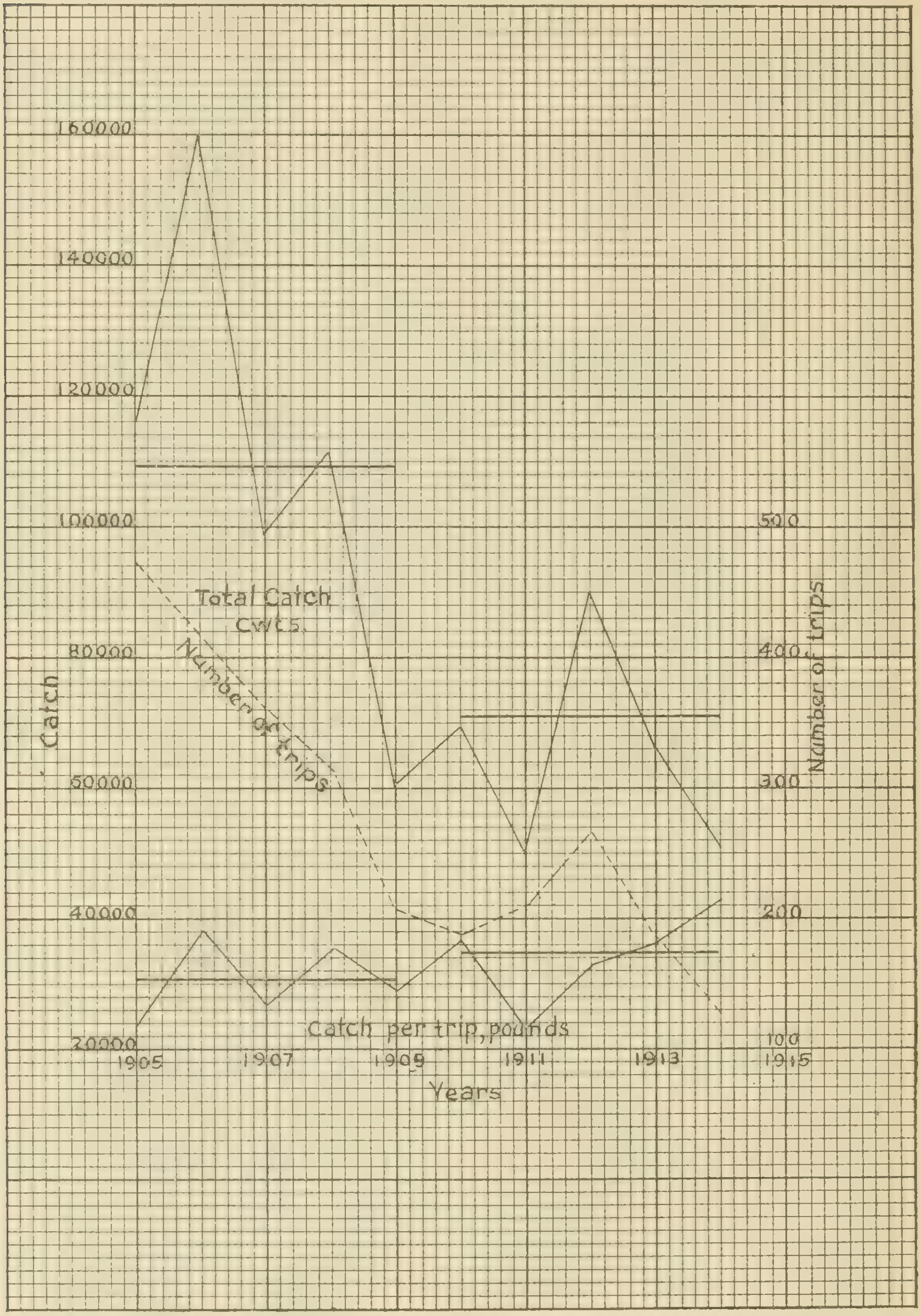


Diagram showing the total combined catch of cod, haddock, and hake, in hundredweights, average catch per trip in pounds, and number of trips made by Gloucester line fishermen on Georges Bank. The heavy horizontal lines show the average catch for five-year periods.

shown signs of overfishing since the first use of the steam trawler in 1905.

The increase in the catch of haddock per voyage of liners in 1914 can not be ascribed to an increased catch of scrod, for very few of the latter were taken, and the data show that very few are taken by liners even when the small fish are present in large numbers and are taken by the trawlers on the same ground. An examination of the monthly returns of this fishery shows that about 80 per cent of the haddock were taken in August and September, when the average per trip was nearly 40,000 pounds, as compared with an average of nearly 21,000 pounds for the year. The average for the remaining months was therefore comparatively low, and this doubtless has

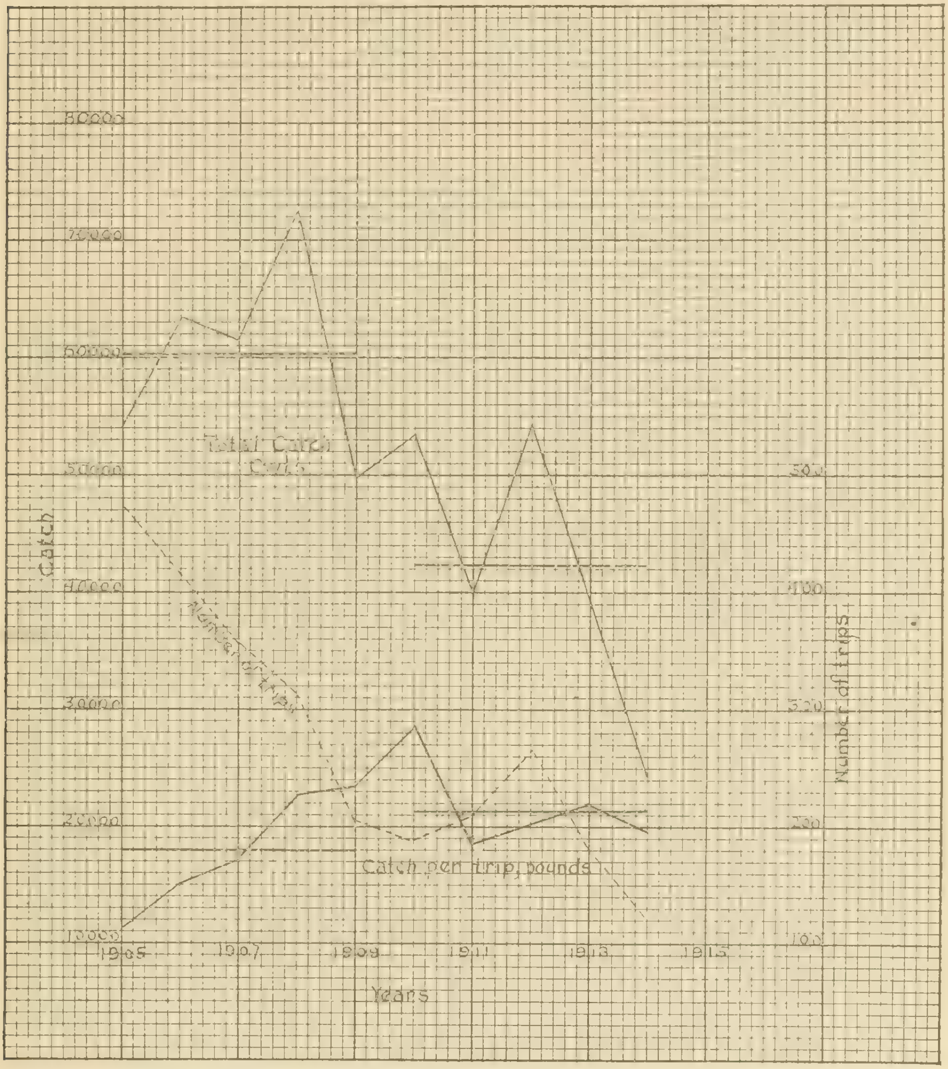


Diagram showing the total catch of cod in hundredweights, average catch per trip in pounds, and number of trips made by Gloucester line fishermen on Georges Bank. The heavy horizontal lines show the average catch for five-year periods.

given rise to the opinion of the fishermen that the fishery has been a failure, a view in which we can not concur. The total yield for the year is the true criterion. It may be noted that the heaviest catch of the Boston fleet was made in January, February, and March, when Gloucester vessels made a monthly average of four trips to

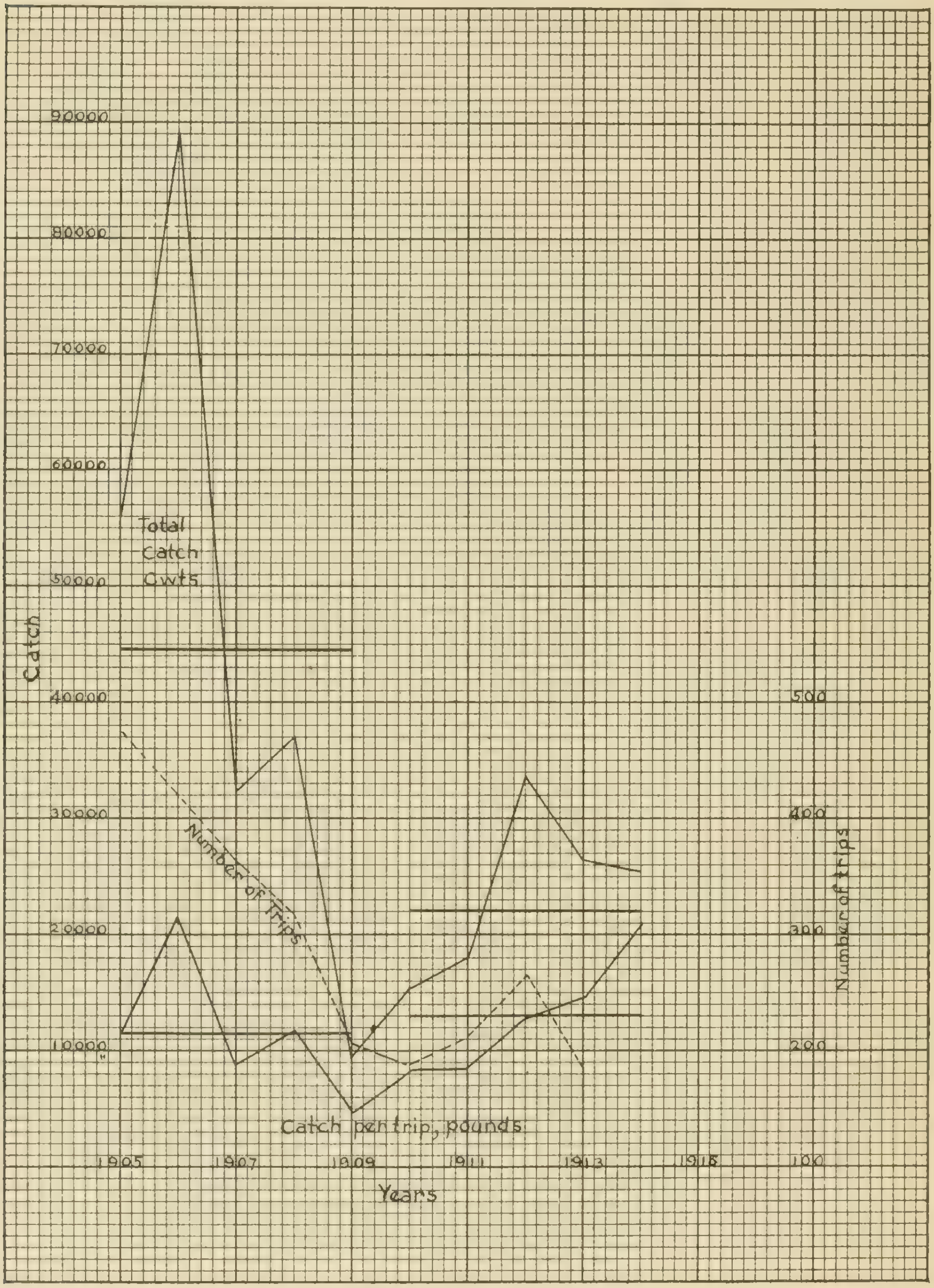


Diagram showing the total catch of haddock in hundredweights, average catch per trip in pounds, and number of trips made by Gloucester line fishermen on Georges Bank. The heavy horizontal lines show the average catch for five-year periods.

Georges, as compared with an average of over 12 trips per month for the rest of the year.

Considering all of the data available respecting the supply of fish and particularly the haddock, the species most conspicuous in the catch of the otter trawlers, we can see no evidence of the depletion of the supply on the fishing grounds frequented by the otter trawlers. The average catch per trip shows no diminution from that made prior to the introduction of the steam trawlers.

DENUDATION OF THE BOTTOM BY OTTER TRAWLERS.

One of the most vigorously urged objections to the use of the otter trawl is that it tears loose, dislodges, crushes, and destroys the marine animal and vegetable growths which in places cover the bottom on the fishing banks. It is upon these sessile or attached organisms and the animals of many kinds to which they give harbor that the bottom fishes feed, and if it can be shown that any method of fishing or any practice of the fisheries denudes the bottom of any considerable proportion of these growths, it would establish abundant reason for regarding such fishery or practice as inimical to the productiveness of the banks.

The attached animals on the banks consist generally of sponges; hydroids and bryozoans, collectively called "sea moss" by the fishermen; ascidians, known as "lemons" and "strawberries"; sea anemones; mussels and other mollusks; burrowing and tube-building worms ("macaroni"); barnacles, etc. With the exception of many of the worms which burrow in sand or mud, the sessile forms are attached to rocks, pebbles, and shells, or to one another. Finding shelter among these or lying on the bottom are various species of crabs, shrimps, and other crustaceans; scallops, clams, and other bivalve mollusks; a variety of gasteropods or snail-like mollusks; many starfishes and brittle stars; sea urchins; sea cucumbers or "pumpkins"; worms; and fishes of various kinds, all preying or being preyed upon and in complex and intimate relation to one another generally. There are many minute animals and plants on the bottom and on the bottom growths or in the overlying water. Of these the microscopic plants are highly important, as they, with the seaweeds, are the fundamental source of food, direct or indirect, of all marine animals. Some of the fishes feed directly on these organisms, while others feed on animals which either consume them directly or at some more or less proximate stage find them in the chain of elaboration of their food supply.

The immediately important commercial fishes taken by the line trawlers are haddock, cod, and, to a less degree, hake. The same market fish with the addition of the "sole" are taken by the otter trawlers. Both methods of fishing catch a few halibut and certain edible fishes which are not marketed. The haddock and the cod are the principal species sought, and were it not for these the bank fisheries would not exist under present economic conditions.

Both of these fish are bottom feeders, and while they feed to some extent on young or small fishes, their diet consists principally of invertebrates such as constitute the bottom fauna of the banks. They all sometimes contain pieces of herring and similar fishes, but there is good reason to believe that in most cases these are baits taken from the lines. Most of the food consists of echinoderms (starfishes, brittle stars, sea urchins, and sea cucumbers; lamellibranchs (scallops, mussels, and other bivalves); gasteropods (various snail-like mollusks); crustaceans (crabs and shrimps); and annelids (worms). Although these fishes spawn on some of the banks, they resort to them primarily for food; and there is no doubt that if the bottom growth were destroyed the productiveness of the fishing banks would be seriously impaired if not destroyed, and it is therefore important to the present inquiry that the methods of fishing now pursued should be considered in relation to their effects on the denudation of the bottom.

In this respect the trawl-line fishery is innocuous and need not be discussed, but the otter trawl operates in such manner as to raise a valid assumption against it and to demand a critical examination of its effects. As the otter trawl, as a whole, sweeps over an area of about 80 acres at each haul and many square miles in the course of a year's fishing, the assumption has been that its effects on the bottom growths of necessity must be disastrous; and the observers on the steamers were instructed particularly to note the quantity and character of the bottom materials brought up. Most of the sand, broken shells, and other fine material not bound together by worm tubes, etc., undoubtedly would wash through the mesh and would not figure in the load landed on deck, but a large part of the bottom growth, which, and not the bottom itself, is the important factor in the present inquiry, would come up in the trawl.

Much of the data submitted by the observers are too vague for quantitative consideration, but one man definitely states the quantities in bushels in his monthly analysis of the results of his observations on each bank. From his returns it is deduced that the average quantity of scallops, clams, shells, sponges, starfishes, and bottom material generally, varied with the month and the locality, from a small fraction of a bushel to 4.7 bushels per haul, the latter being the average of 26 hauls made in South Channel in August, 1913.

A simple computation shows that this maximum represents a film 0.00024 inch in thickness spread over the area swept by the trawl, or, to state the case in another way, a little pile of material 1 foot square and 9 inches high on each acre traversed. This means either that a small proportion of the existing bottom material was captured by the net, which is probable, or that there was very little material to take. In either case the result to the fishery is trivial and negligible, as the whole quantity, shells and all, if eaten by the marketable haddock and cod alone taken in the same hauls would constitute a morsel of but about 2½ cubic inches for each—a very small meal, indeed—and leave nothing for the many other fishes taken at the same time.

But, the evidence shows, this material was not destroyed but thrown overboard when the decks were cleared after each haul, the uninjured organisms in large part to carry on their lives as before, and the dead shells to lie again on the bottom and serve as places for attachment for other growths. Any crushed scallops, mussels, etc., undoubtedly would be eaten by fishes or by animals on which the fishes feed, for no dead organic matter is permitted to lie long unutilized on the floor of the sea. Fragments of sponges would each begin to grow into a new sponge, and mutilated starfishes would soon reproduce the injured or lost parts, if they did not fall prey to the fishes in the meantime. This modicum of captured and liberated material would therefore be little if any diverted from the function which it would have discharged if it had remained unmolested on the bottom. It is claimed, however, that but part of the damage wrought to the bottom by the trawls is represented by the material brought up in the nets, greater quantities of the bottom organisms being torn loose, crushed, and mutilated. To the extent that this may be true, the preceding remarks on the utilization of the detached and injured organisms also apply. It is, of course, impossible to observe the action of trawls operated in depths as great as are found in the bank fisheries, but by an examination of the catch, the method of operating the apparatus, and comparison with the known effects of similar appliances, conclusions of some value may be deduced.

There are three parts of the otter trawl which scrape the bottom: The boards, the foot line, and the net itself. The boards each weigh about 1,500 pounds in the air or about 900 pounds in the water, and as they are 12 feet long and 2½ inches thick they bear on the bottom with a pressure of a little less than 3 pounds to the square inch. This is a little less than the standing pressure of an average man. When the net is fishing, the otter boards are set with the short sides vertical and their long sides at an angle of about 20 degrees or less to the direction of motion, and as they are 12 feet long each scrapes a strip about 4½ feet wide. As the average haul of an otter trawl is about 6 miles, the two boards scrape on each haul a surface of about 6½ acres. An average of about 35 hauls was made on each trip observed, and on this basis it is computed that on the 326 trips made by the steam trawlers in 1913 the boards alone scraped about 115 square miles of the bottom, provided they were in constant contact.

The footline or ground rope forms the front border of that part of the net lying on the bottom. It stretches in a curve between the otter boards, is about 140 feet long, and 3½ to 4 inches in diameter. It is composed of a core of steel wire rope about 1 inch in diameter, heavily served with marlin and rope partly to protect the wire from chafing, but principally to prevent undue cutting into the bottom. The ground rope weighs about 800 pounds in the air, but as rope is but little heavier than water and the wire weighs not over 150 or 160 pounds, it is certain that when at rest it does not exert a pressure in excess of 2 pounds per linear foot.

The ground rope sweeps over a strip about 100 feet wide, and using the same data employed in the discussion of the otter boards this would cover an area of about 73 acres per haul and about 1,300 square miles for all hauls made by the steam trawlers in 1913.

The net with its chafing gear, a device of old netting to minimize abrasion on the bottom, weighs about 800 pounds in air, but very little in water. As fish weigh but little more than water, the catch adds nothing to the pressure of the net on the bottom unless it includes stones, sand, shells, and other heavy materials. The net, being attached to and following the ground rope, sweeps over the same area.

The otter boards, by virtue of their inclined position to the line of draft through the water, act, when resting on the bottom, like the scraper of a road machine, such material as they dislodge or tear loose passing backward and inward toward the net. As the purpose of the boards is to spread the net laterally, no useful purpose is served by permitting them to plow deeply, and the ideal practice is to have them skim over the bottom as lightly as possible. The drag of the towing warps, inclining upward toward the vessel, tends to lift the boards, especially at the forward ends, and this tendency increases with the speed at which they are towed and, at any given depth, inversely with the length of warp paid out. With the speed too great or the warp too short, the boards and with them the net may be lifted quite clear of the bottom. A slight lifting of the boards is permissible and perhaps desirable, but if the ground rope raises materially, the efficiency of the net is impaired.

There are two instruments employed in fisheries in other parts of the world for taking bottom growths, the effects of which are comparatively well known, and a consideration of these, by analogy, may be of some assistance in the formulation of an opinion as to the effects of the otter trawl. One of these is the dredge extensively employed in the oyster fishery. This consists of a short chain bag or net, attached to a rectangular steel frame, about 4 feet on its long sides. The average weight of these dredges is about 150 pounds, and the long sides of the frames are provided with 15 or more long, steel teeth which dig into the bottom as the instrument is dragged over the beds. They are designed especially to tear the oysters from the bed, and incidentally they bring up sponges, starfishes, mussels, and other bottom organisms.

It is estimated on good data that in Maryland the dredging vessels in the course of the season's work cover with their dredges an area equal to about three times that of the oyster beds, or, in other words, an average acre or square mile is scraped three times in the course of the year. These beds have been intensively dredged annually for many years, and while some of them have been depleted, they are still producing large quantities of oysters wherever care has been exercised to return to the beds all shells and small oysters. Where the beds have been depleted it is in nearly every case due to neglect to comply with the requirements of the law in this respect.

The other implement to which reference was made in a preceding paragraph is the gaugava, a peculiar type of dredge trawl used in the Mediterranean sponge fisheries. It consists of a short bag net of heavy twine attached to a rectangular frame about 35 feet long and 2 feet high. The lower side and about half of the two ends is composed of an iron bar 2½ to 3 inches in diameter weighing about 600 or 700 pounds, and the top of the frame is a wooden bar 5 or 6 inches in diameter. This implement is towed at a speed of about 1 to 1½ miles per hour, and the length of the towing warp is so adjusted that the iron bar scours the bottom without burrowing. The purpose of the gaugava is to tear commercial sponges from their firm attachments to the bottom and incidentally it brings up all other bottom growths. It is undoubtedly the most destructive method of sponge fishing, as it tears from their attachment many commercial sponges too small for the market which would be valuable if permitted to become a year or two older. Yet 150 vessels are using this appliance on the coast of Tunisia, and while the beds have been depleted to some extent and require occasional periods of recuperation, they are after many years still profitably productive. Now both the oyster dredge and the gaugava are designed for tearing up and capturing the bottom growth, they are employed in a way to accomplish that purpose, and a large part of the material captured is not returned to the water. Each of them is much heavier than the ground rope of the otter trawl, the dredge weighing in water about 30 to 35 pounds to the linear foot, the gaugava about 15 pounds, and the footrope of the trawl less than 2 pounds.

The footrope of the trawl is of larger diameter than the frames of the other two implements, and, moreover, it is covered with rope, a cushioning material, while the others are bare steel. It is evident that if it were towed at the same speed as the oyster dredge and the gaugava it would do much less damage owing to its comparatively small weight per foot, but it is dragged at a much higher speed than the oyster dredge and at about three times the speed of the gaugava, which it more closely resembles. With the same length of warp, dredges and trawls touch the bottom more lightly the higher the speed at which they are towed, and at the same speed the lighter and more bulky gear lifts more freely than the heavier and more compact. That the otter trawl catches an insigificant quantity of bottom material as compared with the oyster dredge and the gaugava has been shown by direct observation, and that it does a negligible amount of damage not observable is clear from a comparison of the construction and methods of operation of the three types of apparatus and a consideration of the fact that years of intensive operation of the dredge and gaugava have by no means destroyed, although they have to some extent depleted, the beds on which they work, especially when recklessly used. The only parts of the otter trawl which have sufficient weight to effectively scrape the bottom of its attached organisms are the boards, and they cover but about 10 per cent of the sweep of the net and undoubtedly are much of the time largely and part of the time wholly supported by the draft of the towing warps.

It is believed, therefore, that denudation of the bottom is not a momentous factor in any injury which may be wrought to the fisheries by the otter trawls.

DESTRUCTION OF SPAWN BY OTTER TRAWLERS.

The allegation sometimes made that the otter trawl destroys the spawn of food fishes can be dismissed with a simple negation. The eggs of all of the important food fishes of the New England coast and the banks, except the herring, are pelagic; that is, they float at or near the surface.

The only destruction of spawn is that involved in taking spawning fish, and such fish are also taken on hand lines on Georges Bank at least and by nets along the coast.

INTERFERENCE OF THE OTTER TRAWL WITH OTHER FISHERIES.

The observers on the vessels were instructed to make note of all cases in which lines or other fishing gear were destroyed or interfered with by the steam trawlers. Very few cases of such destruction or interference were noted.

Mr. Walter H. Rich, who served from June to November, inclusive, most of the time on steam trawlers, but who made a number of trips on trawl liners, says: "The captains of all steamers use care in avoiding the trawls of the sail fleet when possible, often taking up the net before a haul was finished when they approached a line of dories engaged in fishing. On two occasions only did the writer see the gear of the line trawlers fouled in the net, both in thick fog, and in each case the line was cut and knotted together and put overside with no apparent damage to the gear."

Mr. John N. Burrows, who made 10 trips on trawl liners between June 24 and December 29, most of them on banks fished by the otter trawlers, and served on otter trawlers from April to December, reports no cases of interference; and Mr. Thomas M. Douthart, who made observations on the steamers from January 17 to May 1 and one trip on a schooner, says: "The trawlers make particular effort to keep clear of other fishing gear."

The testimony of the other observers was similar, and there is no doubt that during the year 1913 the damage to trawl lines was negligible, and what little did occur was unintentional.

GENERAL ECONOMIC AND SOCIOLOGICAL QUESTIONS.

The general economic and social effects of a change in the character of the bank fisheries, due to the introduction of otter trawling, are matters which we do not regard as within our province to discuss in detail. We believe that the unregulated use of otter trawls will inevitably result in the practical displacement of the less efficient line fishery, and that this will induce a change in the character of the men manning the fleet, as the substitution of steam for sail power has changed the type of crews in the merchant marine and in the Navy. There is also the probability, in fact almost the certainty, that the change would result in a reduction in the number of individual vessel owners and the concentration of ownership of fishing craft in the hands of a comparatively small number of firms and corporations. Whether or not these changes be desirable is a matter to be judged by the same criteria governing opinion respecting similar phenomena affecting other industries.

The regulation of the fisheries is predicated on the necessity of providing and conserving a common food supply, and the special protection which it receives at the hands of the Government is to that end. The consideration of broad subjects of social welfare should be divorced from special application, and we do not regard them as germane or peculiar to the investigation with which we are charged.

It should be indicated, however, that the changes enumerated would have, in addition to a great reduction in the number of men employed on the fishing fleet, certain collateral results of wide reaching effect. The men employed in catching bait[a] would lose their calling; the cold-storage plants preserving food fish and bait at various places on the coasts would lose a material part of their business; shipbuilders, manufacturers, and artisans employed in supplying the sailing fleet would find their business destroyed or seriously curtailed; and a wide economic readjustment would be obligatory in many communities.

On the other hand, the general substitution of otter trawls for lines will result in the stimulation of steel shipbuilding and related industries and furnish additional markets for coal, oil, and engineering supplies. The trawl nets are now purchased in Great Britain. A canning establishment which recently began utilizing the bank fishes now depends largely on the otter trawls for its raw material. Whether its continuance is contingent on the permanence of the otter-trawl fishery is not known to us.

EFFECTS OF OTTER TRAWLING ON THE PRICE OF FISH.

An important element in the case of lines versus otter trawls is whether the introduction of the admittedly more efficient apparatus will result in a reduction in the cost of fish. The consumer, who is the factor of paramount economic importance, rarely is heard when industrial legislation is being considered, and for that reason we have departed from our avowed purpose to refrain from discussion of general economic matters not peculiar to the fisheries and have endeavored to arrive at an understanding as to the probable effect of otter trawls on the trend of prices. For this purpose we have examined the prices at which the important species of the cod family and fresh fish as a whole have sold in Boston during each year since 1898. These data are shown in the following table and in the diagram based thereon:

Prices Received by Fishermen for Fresh Fish Landed at Boston, 1898 to 1914, Inclusive.

Year.	Cents per pound.				Year.	Cents per pound.			
	Cod.	Haddock.	Hake.	All fish.[b]		Cod.	Haddock.	Hake.	All fish.[b]
1898	2.1	1.7	0.9	1.8	1907	2.9	2.9	1.9	2.8
1899	2.2	2.2	1.1	2.1	1908	2.7	2.5	1.7	2.5
1900	2.2	2.0	1.4	2.2	1909	2.8	2.5	1.5	2.5
1901	2.7	2.4	1.5	2.6	1910	3.0	2.5	1.6	2.6
1902	2.4	2.2	1.7	2.4	1911	3.2	2.3	2.0	2.7
1903	2.9	2.2	1.6	2.4	1912	3.3	2.2	1.8	2.6
1904	3.0	2.3	1.3	2.5	1913	3.4	2.9	2.3	3.1
1905	2.6	2.1	1.7	2.3	1914	2.7	2.5	2.2	2.8
1906	2.4	2.0	1.9	2.2					

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[a] Some estimates indicate that 50,000,000 pounds of bait, caught by boat and trap fishermen, are used in the line fisheries conducted by New England bank vessels.

[b] Excepting mackerel. Herring could not be excluded for lack of data.

The table, and particularly the diagram plotted from it, shows a consistent, though fluctuating, increase during the 16 years ended in 1913 in the prices of each of the species separately enumerated, as well as in the prices of fresh fish as a whole. At the end of that period all prices except for haddock were higher than ever, although for 1912 and the five years preceding there had been but little or no general price increase, the cod alone excepted. In 1914, however, there was a noteworthy drop in the price of cod, which was reflected in the average price for all fish, while haddock and hake likewise showed a decline.

To determine whether the recent comparative maintenance of prices was due to the larger number of small fishes landed by the steam trawlers, the following table has been prepared. It should be explained, however, that the table immediately preceding and the one following, except for the year 1914, were derived from two separate sets of statistics and are, therefore, not exactly comparable, but each by itself indicates the general tendency of the prices. The first table was computed from the statistical bulletins of the Bureau of Fisheries, in which the trade sizes of cod, haddock, and hake were not available prior to 1914. The second table was taken from the books of the New England Fish Exchange, which provided data regarding the sizes as far back as 1909 only.

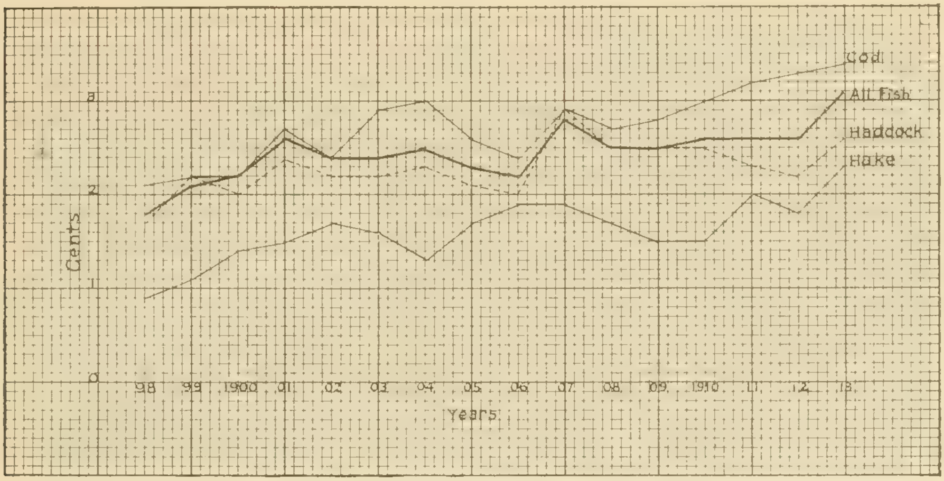

Diagram showing average prices per pound received by fishermen for certain fishes landed in Boston.

AVERAGE PRICES OF FRESH BOTTOM OR BANK FISHES SOLD AT THE NEW ENGLAND FISH EXCHANGE, BOSTON, 1909 TO 1914, INCLUSIVE.

Species and sizes of fish.	Cents per pound.					
	1909	1910	1911	1912	1913	1914
Cod:						
Large	3.3	3.5	3.8	3.9	4.6	4.1
Market	2.1	2.4	2.7	2.4	2.5	2.1
Scrod	1.8	2.4	2.1	1.8	1.7	1.4
Haddock:						
Large	2.4	2.5	2.2	2.1	2.9	2.6
Scrod	1.7	2.0	1.9	1.5	2.1	1.7
Hake:						
Large	1.9	2.4	2.3	2.7	2.9	3.1
Small	1.2	1.6	1.5	1.3	1.6	1.7
Sole	2.3	2.4	1.9	2.0	2.9	3.6

It appears from this table that between 1909, when there was but one steam trawler fishing, and 1913, in the latter part of which 10 such vessels were employed, there was an increase in the prices of all sizes of the principal demersal fishes, with the exception of scrod cod. This increase manifested itself in all years excepting 1912, when there was the largest catch of which we have record, and the prices of haddock and scrod haddock fell below those of the preceding 4 or 5 years. The figures for 1914, however, show a fall in the prices for all sizes of cod and haddock and a rise in the prices for large and small hake and for “sole.” It is deduced from a combination of the data presented by the two sets of tables that within the past few years the advance in the prices of cod and haddock as a whole has been slightly retarded by the large quantity of the smaller and cheaper fish brought in by the steam trawlers.

It must be stated, however, that the otter trawl has not been used for a sufficient length of time in American waters, nor has it attained sufficient importance as compared with the line fisheries to have much influence on the trend of prices, but a study of the conditions in Europe throws some light on the subject.

In England and Wales the otter trawl supplanted the beam trawl, to the practical exclusion of the latter, about 1898. Data dating from that time are available as showing the trend of prices of fish in the countries named, and these for several of the more important and characteristic species, and, combined, for all fish commonly taken in the trawls, are shown in the following table and diagram:

AVERAGE PRICES OF FRESH FISH LANDED IN ENGLAND AND WALES, 1898 TO 1913, INCLUSIVE.

Year.	Cents per pound.						
	Cod.	Haddock.	Hake.	Sole.	Lemon sole.	Plaice.	All fish.
1898	3.4	2.8	3.4	34.6	....	5.9	3.4
1899	3.5	3.0	3.3	34.9	....	5.9	3.5
1900	3.5	3.3	3.8	36.5	....	5.8	3.7
1901	3.7	3.5	3.5	35.6	....	5.3	3.6
1902	2.8	3.0	3.6	33.1	10.9	3.9	3.0
1903	2.9	2.4	3.2	31.9	11.9	4.6	3.0
1904	2.8	2.5	2.9	28.8	11.3	4.2	2.7
1905	3.1	3.0	3.2	28.5	11.1	4.5	3.1
1906	2.8	2.4	3.4	31.5	12.2	5.4	3.0
1907	3.0	2.5	3.3	33.6	12.1	4.7	2.7
1908	2.9	2.7	3.2	31.6	10.9	5.0	2.8
1909	2.1	2.6	3.1	31.8	9.6	4.2	2.6
1910	2.4	2.9	3.7	33.3	10.7	4.9	2.9
1911	2.4	2.9	3.7	31.6	10.9	4.9	2.7
1912	2.8	3.3	4.0	32.1	11.6	6.1	2.9
1913	3.1	4.1	5.1	33.7	12.2	7.0	3.0

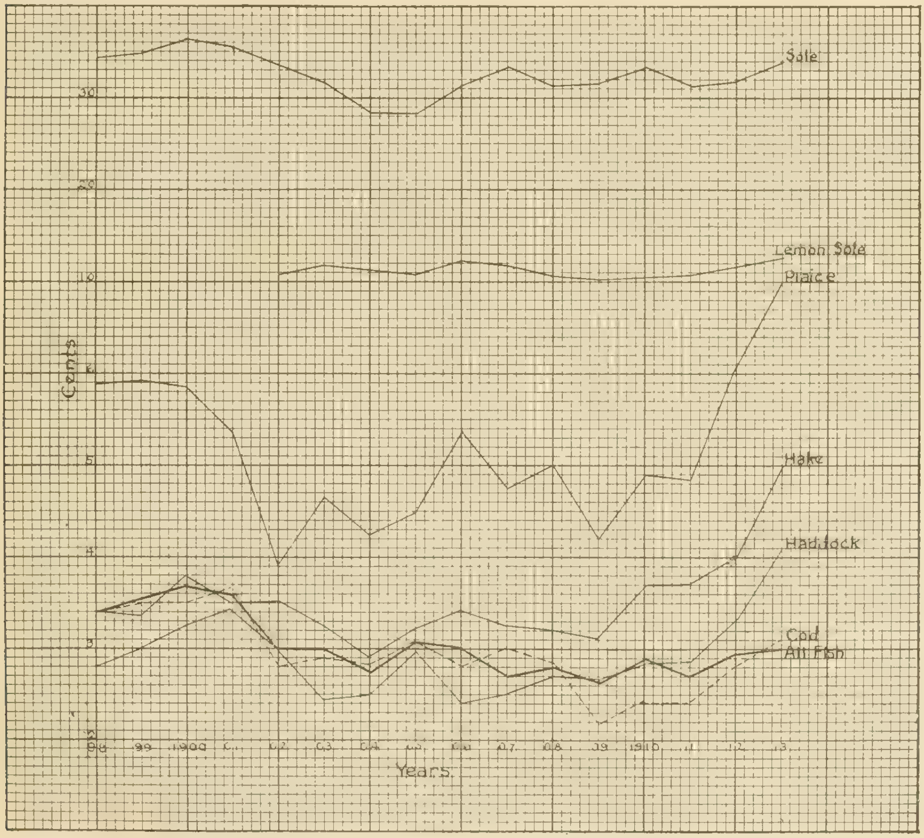

Diagram showing average prices of fresh fish per pound received by fishermen for certain fishes landed in England and Wales.

From 1898 to about 1900 or 1901 there was a slight increase in the average price, but henceforth to 1911 there was a distinct and consistent downward trend in all species excepting the hake, for which there was a growing demand outrunning the supply. In 1912, as is graphically shown in the diagram, there was a sharp upward turn in the price of all of the cheaper fish and a slight rise in the more expensive kinds, and this tendency was accentuated in 1913. In the latter year, haddock, hake, and plaice were all considerably higher than in any year here recorded, lemon soles were higher than at any time since they have been separately listed, soles and cod were higher than since 1901, and demersal fish as a whole had returned in average price to the level of 1912.

Therefore, while the average prices of the most important species of demersal fishes have been, in general, lower since the otter trawl supplanted previous methods of fishing, they were in 1913, the latest year of which we have record, higher than in 1898, with the single exception of the cod; and in the case of the haddock, hake, and plaice, the increase has been large.

It should be noted, also, that with respect to the cod there has been a decrease in the proportion of the larger and more valuable sizes since 1903, at least, and a corresponding increase in the small ones. In the plaice, the large size has diminished proportionately to both the medium and small. In respect to these species, therefore, the increased marketings of the smaller and cheaper sizes has had a tendency to repress the upward trend of prices, which would have been more marked if the relations of the sizes in earlier years had been maintained.

In regard to the haddock, which is the other most important trawl-caught fish, the situation is peculiar. The statistics show a material increase in the proportion of large fish landed, a slight decrease in the medium size, and a considerable decrease in the proportion of small. As the total catch of the species has decreased, it is believed that the condition shown by the statistics has been brought about by the transfer of fish formerly rated as medium to the category of large, and of small fish to the medium class. That this may be true is indicated further by the fact that while small haddock brought but 28 per cent of the price of large ones in 1906, they brought 75 per cent in 1912 and 80 per cent in 1913. In later years, all three classes have more nearly approached parity in price, presumably because, to some extent, they were more nearly approaching parity in dimensions. It should be mentioned, however, that this evening up of the prices was doubtless due, in some degree, to the education of the public to consume smaller fish. Unfortunately, there have been no fixed or recorded standards of the sizes of fishes, and it is known that the standards vary as between the several ports and at the same port from time to time. In view of all considerations, however, we believe that the average size of all haddock taken has decreased, and that the prices would probably be higher than they are if the former standard had been maintained.

To summarize, while the otter trawl in England and Wales reduced the cost of production of fish for a number of years after it became the predominant method of fishing, it did this to some extent by reducing the standard of sizes, and within the last two years prices have increased rapidly until they are higher than ever. To what extent the general increase in commodity prices has been responsible can not be determined.

It may be noted that the increase in the price of fish in 1912 and 1913 occurred in the face of the heaviest fisheries that Great Britain has ever known, in which, however, the species taken in the trawl fishery did not participate.

INSUFFICIENCY OF DATA.

While certain provisional deductions are drawn from the preceding analysis, the data are not regarded as sufficient to warrant an opinion respecting the effects of steam trawling on the fisheries. The period during which the American trawlers have operated has been too short, the trawlers engaged have been too few, and their catch, relatively to the catch by liners fishing on the same banks, has been too small to make it probable that they could have shown any drastic effect. Such fluctuations as have occurred during the time may have been merely the periodical changes common to all fisheries. For this reason it has been necessary to consider what is known of the fisery in the North Sea, the region in which it has reached its greatest development, and where it has been prosecuted for the longest time. The only data for a sufficiently long period available to the committee considering the subject are those contained in the Annual Reports on Sea Fisheries of England and Wales and the Annual Reports of the Fishery Board for Scotland. These two countries have four-fifths of the North Sea trawlers, catch over two-thirds of all fishes taken in the North Sea and over three-fourths of all demersal fishes landed from that region, and, therefore, if an analysis of the statistics develops any pronounced facts, they can be assumed, with some safety, to be applicable to the North Sea fisheries as a whole.

The statistical publications of The Permanent International Council for the Exploration of the Sea contain interesting detailed information respecting other countries in recent years, but as this can not well be correlated with the data from earlier periods it has not been used. Unfortunately, the same difficulty has been encountered in a measure in dealing with the English and Scotch statistics. The forms of the tables, the character of the data which they contain, the classification of the fishes, and the detail and particularity of the data have been changed from time to time. This has not only entailed great labor in an effort to arrive at the facts, but has necessitated some lack of uniformity in the consideration of the several periods, and has also, taken in connection with modifications in the methods of the fishery, dictated the selection of the particular periods considered. If the data for the entire series of years had been presented in the form adopted since about 1906, many difficulties would have been removed, and the matter presented in this report would have been more explicit in some respects. While this report appears to consider and compare certain years only, largely for the reasons just explained, all English and Scotch reports since 1891 have been laboriously examined, and it is not believed that if other years were substituted there would be any material change in the apparent trend of the analysis.

MINOR AMERICAN TRAWLNET FISHERIES.

In considering the matter of the regulation of the otter-trawl fishery on the oceanic banks adjacent to the coast of New England, which is the prime purpose of this report, it is necessary to keep in view two minor fisheries prosecuted by the otter trawl or its equivalent concerning which there appears to be little or no complaint.

CAPE COD FLOUNDER FISHERY.

The first of these is the flounder fishery on the shores of Cape Cod. The fishery was established about 1895 or 1896, and 27 trawl nets were in use in 1898. In 1902 the number had increased to 65, and in 1908, the latest year for which we have information, there were 126; it is understood that the number has increased since then.

The vessels in the Cape Cod otter-trawl fleet, which is owned principally in Provincetown, Hyannis, and Falmouth, is composed of craft ranging from motor dories to auxiliary motor vessels of 25 to 30 tons. Beam trawls were formerly employed, but they have been practically supplanted by otter trawls measuring from 30 to 50 feet between the boards. The fishery is conducted in depths of 10 fathoms, more or less, and as it is confined to Cape Cod Bay and Nantucket Sound, it is within territorial waters and, therefore, within the jurisdiction of Massachusetts. Few fishes other than flounders are taken, the principal species being the winter flounder, locally known as the "black back," and the rusty dab, known to the fishermen by the name of "fluke" and "yellow tail." The present catch of these trawls is not known, but in 1898 they took 766,850 pounds, valued at $8,564; in 1902, 1,419,809 pounds, valued at $43,169; and in 1908, 2,893,000 pounds, yielding the fishermen $64,000. At Hyannis and Falmouth the trawl fishery is of very recent development.

Previous to 1908, from 6 to 12 small boats employing hand lines made an aggregate annual catch of 200 to 300 barrels. With the introduction of beam trawls, more than 125 men have gone into the business in Hyannis and Falmouth, and in the season of 1910 and 1911 they caught and marketed 11,500 barrels (over 2,575,000 pounds) of winter flounder, receiving therefor the sum of $57,500.[a] As comparatively few of these fishes are taken by other methods, the otter trawl in this case has added to the food supply a fishery product not otherwise largely available.

SAN FRANCISCO PARANZELLA FISHERY.

This fishery was introduced from the Mediterranean many years ago and is prosecuted by Italian fishermen employed principally, if not entirely, by two San Francisco companies. In 1908 there were 20 of these nets in use at this port. The paranzella is essentially similar to an otter trawl, but the wings are kept extended not by otter boards but by warps or lines carried to tugs. Two vessels steering on parallel courses are required to operate a net. The tugs are about 85 feet long and of 30 tons net register, with an engine of about 150 horsepower and a crew of 11 men.

In 1908 the paranzella nets caught 4,722,000 pounds of fish valued at $87,000, of which 3,629,000 pounds valued at $68,000 were flounders and soles. No large numbers of fishes important to the line fisheries are taken. The fishing ground is a strip about 50 miles long and 5 miles wide lying about 12 miles seaward from the Golden Gate. There is practically no other fishing on this ground, and, therefore, the paranzella nets do not interfere with other methods of fishing. About 15 per cent of the fish brought up in the net are immature. The fishery is conducted beyond the limits of territorial jurisdiction.

DEMERSAL FISHERIES OF ENGLAND AND WALES.

INTRODUCTION.

In the preparation of this report every effort has been made to trace the history of the demersal fisheries of England and Wales, and especially of the North Sea, continuously from 1891 to the latest date for which data are available, but after careful consideration it has been found necessary to break the continuity of the discussion, because there appears no basis for harmonizing the possible analyses of the statistics prior to 1901 with those which can be made after 1903. In other words, one basis of comparison is possible between the several years of the earlier period and another between those of the later series, but none whatever can be made between 1901 and 1903, when there was an abrupt change in the manner in which the data were presented.

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[a] Report of the Commissioner of Fisheries, 1911, p. 50.

From 1891 to 1901 there are no data relating to the North Sea specifically, but there is material for the consideration of the fishery out of certain east coast ports from which the operations in the North Sea were so overwhelmingly predominant to those carried on in other regions from the same ports that no violence is done to the validity of the discussion by considering that the fishery was conducted in the North Sea alone. These ports were North Shields, Sunderland, Hartlepool, Scarborough, Yarmouth, Lowestoft, and Ramsgate. Grimsby, Hull, and Boston were concerned largely or predominantly in the fisheries in other regions than the North Sea, which would introduce an important error, and they are therefore eliminated from consideration. Furthermore, during the period from 1891 to 1901, while the whole number of vessels is stated in the reports, there is no specific designation of the numbers of the respective classes and types and the catch of each, and as the ratios of these to one another undoubtedly varied from year to year, and as the efficiencies of the different sorts and sizes of vessels and the kinds of fishes which they catch diverge widely no adequate measure of the intensity of the fisheries can be applied.

From 1903 onward the data presented in the reports are much more specific, the catch from the North Sea is definitely given, as are also the number of landings of the different sorts of vessels, the catch of each, and, especially in the later years, the definite character of that catch.

With the reservations and limitations imposed by the conditions thus summarized, it is possible, however, to make some use of the entire series of matter presented in the Annual Reports on Sea Fisheries of England and Wales. If, for instance, a certain tendency should be shown by a comparison of the several years of the earlier period inter se, and the same tendency should be shown by the different sort of analysis required by the character of the data available for the second period, the two presumably would be mutually corroborative. It must be understood definitely and finally, however, that the specific data for one period must not be compared with those for the other.

FISHING REGIONS.

The fishing vessels of England and Wales fish in the following regions, which are specifically designated in the reports for recent years: White Sea, Iceland, Faroe, Rockall, North of Scotland, North Sea, English Channel, Irish Sea, Bristol Channel, Westward of Scotland, West of Ireland, Southward of Ireland, Biscay, and Portugal and Morocco. All of these regions are resorted to by English steam trawlers, in some cases to the total or practical exclusion of other methods of fishing.

Prior to 1906 there is very little specific information furnished in respect to the fisheries on these grounds, but such data as are available indicate the increasing relative importance of the more distant regions as compared with the North Sea. The landings of fish at Grimsby, Hull, and Boston, the ports from which these fisheries were predominant, as compared with the landings at six or seven other east coast ports where the North Sea fishery was paramount, showed an increase from about 73 per cent of the total in 1891 to about 82 per cent in 1901. For 1903 and later years there are specific data for the "North Sea" and "Regions beyond the North Sea"—that is, all others—and the following table shows the proportions of all demersal fish taken by English vessels in these two, respectively:

PERCENTILE PROPORTIONS OF DEMERSAL FISHES CAUGHT IN THE NORTH SEA AND IN REGIONS BEYOND THE NORTH SEA, RESPECTIVELY, BY ENGLISH AND WELSH VESSELS.

Year.	North Sea.	Beyond North Sea.
1903	79.4	20.6
1906	54.7	45.3
1912	43.2	56.8

These complete statistics confirm the deductions from the earlier partial data, that the North Sea has rapidly lost in relative importance to the whole demersal fishery, and that it has now lost its former dominance.

A discussion of all of the 14 regions previously named is not important to the purposes of this report. The North Sea, the seat of the oldest, most important, and most dominant otter-trawl fishery, furnishes the data of most value, and that region is, therefore, considered at the greatest length, but for purposes of comparison, and as a check on the deductions made, it is desirable to analyze the information obtainable respecting certain other regions resembling it in the character of the fishery and the fishes caught. The most suitable for this purpose appear to be Iceland, the White Sea, and Faroe. The areas of the fishing grounds of the four regions, according to the best information obtainable, are as follows:

	Square miles.
North Sea	152,500
Iceland	36,600
White Sea	128,900
Faroe	4,950

These areas, certainly in the case of the North Sea and probably in other cases, are the totals of the waters to which the fishermen resort, and it is at least probable that the whole is not equally productive and that some parts may be practically or completely barren of commercial fishes. Certainly, some parts of the North Sea produce comparatively little, some produce practically nothing but small fish, while others, e. g., Dogger Bank, are highly productive. Probably all of these regions show differences in their several parts, and the product differs with the physical characters. The North Sea south of a line from Flamborough Head to about the northwest point of Denmark is comparatively shallow and is the important plaice region. In this area small plaice abound near the shores and particularly in the southeast portion on the Dutch and German coasts, while the larger fish frequent the offshore banks. North of the line described and along the Norwegian shore the sea is deeper and the haddock becomes of relatively greater importance.

The nature of the fisheries in the North Sea, White Sea, Iceland, and Faroe, and their statistical histories, so far as it is possible to trace them from the information available, are shown in the following pages.

FISHERIES OF THE NORTH SEA.

First-class vessels.—With the exception of a wholly negligible quantity, all of the demersal fishes taken in the North Sea by English vessels are landed on the east coast. The following table makes comparison of the landings of demersal fishes as a whole, and of round fishes and flat fishes, respectively, at east coast ports, the data until 1901 being the total for certain ports and after 1903 for all ports, for reasons previously explained. As practically the entire catch is made by first-class vessels, and as these are the only vessels for which more detailed data presented later are available, they alone will be considered.

TOTAL LANDINGS OF DEMERSAL FISHES, ROUND FISHES, AND FLAT FISHES, FROM THE NORTH SEA ON THE EAST COAST OF ENGLAND IN THE FIRST AND LAST YEARS OF CERTAIN PERIODS.

Classes and periods.	Quantity (hundredweight) during—		Gain or loss.	
	First year.	Last year.	Hundredweight.	Per cent.
Demersal fishes:				
1891–1898	570,818	508,940	− 61,875	−10
1898–1901	508,940	585,436	+ 76,496	+15
1903–1906	5,116,979	4,281,150	−835,829	−16
1906–1912	4,281,150	3,675,862	−605,288	−14
Round fishes:				
1891–1898	304,095	247,109	− 56,986	−18
1898–1901	247,109	264,470	+ 17,361	+ 7
1903–1906	3,492,414	3,158,062	−334,352	− 9
1906–1912	3,158,062	2,605,812	−552,250	−17
Flat fishes:				
1891–1898	266,723	261,831	− 44,892	− 1
1898–1901	261,831	320,966	+ 59,135	+22
1903–1906	1,492,696	970,509	−522,187	−34
1906–1912	970,509	849,003	−121,506	−12

NOTE.—The data for 1891 to 1901, inclusive, are for certain ports only, enumerated in the text.

It is apparent from the foregoing that from 1891 to 1901 the catch of demersal fishes fluctuated, but showed a slight net gain for the period, and that while the fluctuation was exhibited in the catch of both round fishes and flat fishes, the former registered a net loss and the latter a net gain for the whole period. The period from 1903 to 1912 was characterized by consistent losses in both round fishes and flat fishes, but more especially in the latter, which of course resulted in a heavy loss in demersal fishes as a whole.

The catches of cod, haddock, and plaice combined have averaged from 87 per cent of the demersal fishes taken in the North Sea to about 72 per cent; cod and haddock constitute about 90 per cent of the round fishes, and plaice from about 60 to 75 per cent of the flat fishes. The following table compares the catches of these three species in the respective years considered in this report:

TOTAL LANDINGS OF THE THREE IMPORTANT DEMERSAL FISHES FROM THE NORTH SEA ON THE EAST COAST OF ENGLAND IN THE FIRST AND LAST YEARS OF CERTAIN PERIODS.

Species and periods.	Quantity (hundredweight) during—		Gain or loss.	
	First year.	Last year.	Hundredweight.	Per cent.
Cod:				
1891–1898	91,987	94,906	+ 2,919	+ 3
1898–1901	94,906	108,722	+ 13,816	+14
1903–1906	783,782	740,062	− 43,720	− 5
1906–1912	740,062	825,636	+ 85,574	+11
Haddock:				
1891–1898	185,877	125,457	− 60,420	−32
1898–1901	125,457	124,102	− 1,355	− 1
1903–1906	2,310,340	2,046,204	−264,136	−11
1906–1912	2,046,204	1,293,080	−753,124	−36
Plaice:				
1891–1898	200,475	207,933	+ 7,458	+ 3
1898–1901	207,933	270,635	+ 62,702	+30
1903–1906	956,358	570,862	−385,496	−40
1906–1912	570,862	527,088	− 43,774	− 7

NOTE.—The data from 1891 to 1901, inclusive, are for certain ports only, enumerated in the text.

From this table it appears that the total catch of cod increased during the period from 1891 to 1901, but fluctuated, although registering a small net gain from 1903 to 1912; the total yield of haddock from the North Sea decreased consistently and heavily in both periods, while the plaice gained throughout the first period and lost heavily in the second.

First-class steam trawlers.—The landings of fish by steam trawlers prior to 1903 are not separately given, but it can be safely assumed on the authority of a statement made in the report for 1901 that the vast majority of the fish listed in the preceding tables for the years

1891 to 1901, inclusive, were taken by this class of vessels. The trend of the catch of demersal fishes by steam trawlers is therefore indicated by that of first-class vessels as a whole. After 1902 the information is specifically given and is shown in the following table:

QUANTITIES OF DEMERSAL FISHES, CLASSES, AND CERTAIN KINDS FROM THE NORTH SEA LANDED ON THE EAST COAST OF ENGLAND BY FIRST-CLASS STEAM TRAWLERS IN THE FIRST AND LAST YEARS OF CERTAIN PERIODS.

Classes, species, and periods.	Catch (hundredweight) during—		Gain or loss.	
	First year.	Last year.	Hundredweight.	Per cent.
Demersal fishes:				
1903–1906	4,776,081	3,983,020	−793,061	−16
1906–1912	3,983,020	3,361,391	−621,629	−15
Round fishes:				
1903–1906	3,382,316	3,074,932	−307,382	− 9
1906–1912	3,074,932	2,464,094	−610,838	−19
Flat fishes:				
1903–1906	1,264,122	761,393	−502,729	−39
1906–1912	761,393	634,157	−127,236	−16
Cod:				
1903–1906	729,311	705,306	− 24,005	− 3
1906–1912	705,306	786,481	+ 82,175	+11
Haddock:				
1903–1906	2,301,505	2,034,882	−266,623	−11
1906–1912	2,034,882	1,292,743	−742,139	−36
Plaice:				
1903–1906	811,637	440,920	−370,717	−45
1906–1912	440,920	386,690	− 54,230	−11

NOTE.—The quantities for 1906 are the landing in England and Wales, but almost if not quite all were landed on the east coast.

As the cod, haddock, and plaice are the important species, the foregoing data dealing with single years have been checked by comparing the catches of these species for three overlapping four-year periods between 1903 and 1912, inclusive. It will be seen that the results are essentially similar, as indicated by the trend of the total catches of these species by trawlers in the North Sea.

PERCENTILE RATIOS OF CATCHES OF COD, HADDOCK, AND PLAICE BY STEAM TRAWLERS IN THE NORTH SEA, 1906 TO 1909, AND 1909 TO 1912, COMPARED WITH 1903 TO 1906.

Four-year periods.	Percentile ratios.		
	Cod.	Haddock.	Plaice.
1903–1906	100	100	100
1906–1909	105	93	73
1909–1912	122	68	64

It appears that the catch of demersal fish in the North Sea by steam trawlers decreased from 1891 to 1898 and increased sufficiently from 1898 to 1901 to show a small net increase for the entire period, and that round fishes and flat fishes each followed the same general trend. From 1903 to 1906 and again from 1906 to 1912 steam trawl-caught demersal fishes as a whole, as well as both round fishes and flat fishes, showed heavy decreases, the total percentile falling off in the flat fishes being the greatest.

Steam trawl-caught cod gained in total catch from 1891 to 1898 and from 1898 to 1901 but exhibited a falling off of about 3 per cent from 1903 to 1906. From 1906 to 1912, however, there was a material increase, and it is apparent that the total catch of the species by trawlers increased more or less continuously from 1891 to 1912. Steam trawl-caught haddock on the contrary declined in total throughout the entire time, and in the two periods, from 1891 to 1901, and from 1903 to 1912, the decreases amounted to 33 per cent and 44 per cent, respectively. In the case of the plaice there was an increase in the catch between both 1891 and 1898 and 1898 and 1901, the aggregate of the two amounting to 35 per cent of the catch of 1891. In both 1906 and 1912 the catch was much less than in 1913, and the decrease in the entire period was nearly 53 per cent. For the entire term from 1891 to 1912 there was, therefore, an increase in the total catch of cod by steam trawlers and a decrease in the catches of haddock and plaice, especially the former.

The foregoing discussion is concerned with the total catches of the several classes, categories, and kinds of fishes; but while the indicated changes were taking place there were synchronous but not necessarily parallel changes in the composition and fishing power of the fleet and variations in the intensity of the fishery conducted by it. To eliminate these variables as far as possible the catch may be reduced to the average per vessel, the average per voyage, or the average per day's absence from port. The first is objectionable in that it does not eliminate the effects of variations in the number of vessels tied up for variable and undeterminable periods, and we have, therefore, confined ourselves to the consideration of the other two.

Unfortunately these methods of analysis can not be applied at all prior to 1903, as the data are not furnished in the reports, and for 1903 and the following years the average catch per day's absence is stated for a part only of the total catch (that not landed in London where most of the fish are brought in by carriers and not by the fishermen). The catch per voyage is not given at all, although the average duration of the voyages is given for all ports excluding London.

As this information applies to the major portion of the fishing operations, it may be assumed that it is reasonably applicable to all, and, following a suggestion in the report of 1906,[a] we have calculated from these data the hypothetical number of voyages and days' absence required to catch all of the fish taken by English trawlers in the North Sea. The following tables are based on the factors so derived.

The total number of steam trawlers in England and Wales does not appear ascertainable for 1891 and 1898, but there were about 500 in 1893 and 1,116 in 1899. In 1901 there were 1,096; in 1903, 1,135; in 1906, 1,254; and in 1912, 1,341. While this rapid increase in the fleet was occurring there was a continuous growth in the size of the vessels from an average of 41 tons in 1893 to 72 tons in 1912. There was, therefore, not only a heavy increase in the size of the fleet, but also in the fishing power and efficiency of its units. Not all of these vessels fished in the North Sea, and some of them fished both there and elsewhere. We have no data as to the number fishing there in any year, but for 1903 and later years there is available the more specific information concerning the number of landings and the number of voyages referred to in the preceding paragraphs.

TOTAL NUMBER OF DAYS' ABSENCE AND THE TOTAL NUMBER OF VOYAGES (LANDINGS) BY STEAM TRAWLERS FISHING IN THE NORTH SEA FROM PORTS ON THE EAST COAST OF ENGLAND.

Periods.	Number during—		Loss.	
	First year.	Last year.	Number.	Per cent.
Total days' absence:				
1903–1906	256,228	225,923	30,305	11.8
1906–1912	225,923	213,286	12,637	5.5
Number of voyages (landings):				
1903–1906	36,852	36,474	378	1.0
1906–1912	36,474	36,118	356	.9

The number of days' absence from port has decreased, while the number of landings has remained practically stationary. The average length of voyages, therefore, has decreased from 6.95 days in 1903 to 5.73 days in 1912, a development probably due to the increased steaming and fishing gear and improvement in the general efficiency of the vessels and their gear. That the number of landings has not increased with the increase in the number and power of English trawlers indicates that to a relatively greater extent than formerly the vessels are fishing in regions other than the North Sea, a fact known from other sources of information.

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[a] Annual Report Sea Fisheries, England and Wales, 1906, pp. viii–xi.

Average Catch of Steam Trawlers Fishing in the North Sea from the East Coast of England per Day of Absence During the First and Last Years of Certain Periods.

Species and periods.	Catch (hundredweight) during—		Gain or loss.	
	First year.	Last year.	Hundredweight.	Per cent.
Demersal fishes:				
1903–1906	18.64	17.63	−1.0	−5
1906–1912	17.63	15.76	−1.9	−10
Cod:				
1903–1906	3.1	3.5	+0.4	+12
1906–1912	3.5	4.45	+0.9	+27
Haddock:				
1903–1906	8.3	7.8	−0.5	−6
1906–1912	7.8	4.8	−3.0	−38
Plaice:				
1903–1906	3.1	2.1	−1.0	−30
1906–1912	3.1	2.34	+0.2	+11

Average Catch per Voyage of Steam Trawlers Fishing in the North Sea from the East Coast of England During the First and Last Years of Certain Periods.

Species and periods.	Catch (hundredweight) during—		Gain or loss.	
	First year.	Last year.	Hundredweight.	Per cent.
Demersal fishes:				
1903–1906	129.6	109.2	−20.4	−15
1906–1912	109.2	90.3	−18.9	−17
Cod:				
1903–1906	21.7	21.9	+0.2	+9
1906–1912	21.9	25.8	+3.9	+17
Haddock:				
1903–1906	57.9	48.5	−9.4	−16
1906–1912	48.5	27.4	−21.1	−43
Plaice:				
1903–1906	21.2	13.3	−7.9	−32
1906–1912	13.3	13.4	+0.1	+0.7

These two tables show the same facts, namely, that on whichever basis computed, the average catch of demersal fishes by steam trawlers has decreased from 1903 to 1912, the average catch of cod has materially increased, while the yields of haddock and plaice per unit of effort have decreased, the former over 53 per cent and the latter over 37 per cent.

A frequent manifestation of the results of overfishing is the permanent relative increase in the catch of small fishes, particularly if the absolute quantity of the catch of large fishes or of the species as a whole remains stationary or diminishes.

As a fishery increases, the total quantities of the catch will also increase, while the ratios existing between the catch of the various sizes will be maintained provided that the size and composition of the fish schools remain unimpaired. When overfishing occurs, however, there is a tendency to change the composition of the schools even though the aggregate number of individuals composing them may not be reduced. The larger fish are taken in at least the full proportion in which they exist in the schools and at the same time increased numbers of the immediately smaller fishes are taken and fewer are left to develop into large, and the numbers of the latter are gradually reduced both absolutely and relatively. We have a particularly well-known and conspicuous example of this in the lobster fisheries of New England.

The following table analyzes the catches of cod, haddock, and plaice in respect to their relative size components:

PERCENTILE RATIOS OF EACH SIZE OF COD, HADDOCK, AND PLAICE TO TOTAL OF ALL SIZES LANDED IN ENGLAND AND WALES FROM THE NORTH SEA BY FIRST-CLASS STEAM TRAWLERS IN 4-YEAR PERIODS, 1903 TO 1912, INCLUSIVE.

Species and sizes.	Percentile ratios to all sizes.[a]		
	1903–1906	1906–1909	1909–1912
Cod:			
Large	43	42	33
Medium	30	25	25
Small	26	33	42
Haddock:			
Large	29	30	39
Medium	28	15	13
Small	43	55	48
Plaice:			
Large	24	25	21
Medium	31	30	32
Small	45	45	47

[a] In 1903 the data of landings on the east coast only are available, but the landings elsewhere were negligible.

It will be seen that the cod shows a material reduction in the ratio of large fish to the total, a smaller reduction in the medium fish, and a heavy increase in the ratio of small. The plaice exhibits a slight reduction in the relative catch of large fish, and a corresponding increase in the small, the proportion of medium fish remaining about constant.

The haddock, on the contrary, shows an increase in the ratio of both large and small at the expense of the medium size. So far as the large fish are concerned, we believe the actual facts to be other than as shown, and that the statistical increase has been due to the transfer of what were formerly classed as medium fish to the category of large. We know from official statements that there are no definite standards of size, and that they vary from time to time. In the face of the relatively high price of the large haddock, the absolute great increase in that price in the last 10 years, and the absolute decrease in the catch of that size, it appears to us to be more than probable that the standards have been lowered, and that all categories are as an average smaller fish than formerly. Even if this be the case, the combined catch of large and medium haddock were somewhat smaller in the quadrennial period 1909–1912 and much smaller in 1906–1909 than it was in 1903–1906.

First-class sailing trawlers.—The number of first-class sailing trawlers operating in the North Sea is not definitely determinable, but it is small relatively to the steam trawlers. In all England there was a heavy decrease in this class of vessels from 1891 to 1901, but since then the number has been practically uniform, and it may be assumed that the vessels in the North Sea followed the same course. Specific data of the catch of the sailing trawlers are available after 1902 and are shown in the following tables, which are presented with nothing more than the comment that the operations of these vessels, so far as the catch is concerned, are of such relatively insignificant proportions that they are not worthy of consideration excepting to show that they are insignificant.

QUANTITIES OF DEMERSAL FISHES, CLASSES, AND CERTAIN KINDS FROM THE NORTH SEA LANDED ON THE EAST COAST OF ENGLAND BY FIRST-CLASS SAILING TRAWLERS IN THE FIRST AND LAST YEARS OF CERTAIN PERIODS.

Classes, species, and periods.	Catch (hundredweight) during—		Gain or loss.	
	First year.	Last year.	Hundredweight.	Per cent.
Demersal fishes:				
1903–1906	277,530	262,504	−15,026	− 5
1906–1912	262,504	279,055	+16,551	+ 6
Round fishes:				
1903–1906	40,004	50,531	+10,527	+26
1906–1912	50,531	55,469	+ 4,938	+ 9
Flat fishes:				
1903–1906	217,502	206,975	−10,527	− 4
1906–1912	206,975	208,072	+ 2,097	+ 1
Cod:				
1903–1906	22,953	17,122	− 5,831	−25
1906–1912	17,122	14,500	− 2,622	−15
Haddock:				
1903–1906	1,059	1,447	+ 388	+36
1906–1912	1,447	0	....	....
Plaice:				
1903–1906	144,667	129,956	−14,711	−10
1906–1912	129,956	140,300	+20,344	+15

AVERAGE CATCH PER DAY'S ABSENCE OF SAILING TRAWLERS IN THE NORTH SEA FROM THE EAST COAST OF ENGLAND DURING THE FIRST AND LAST YEARS OF CERTAIN PERIODS.

Species and periods.	Quantity (hundredweight) during—		Gain or loss.	
	First year.	Last year.	Hundredweight.	Per cent.
Demersal fishes:				
1903–1906	3.11	2.45	−0.66	−21
1906–1912	2.45	3.08	.63	+25
Cod: 1906–1912	.16	.16	....	....
Haddock: 1906–1912	.01	.00	....	....
Plaice: 1906–1912	1.22	1.55	+ .33	+27

Steam liners.—Steam liners, still more than sailing trawlers, bear but an insignificant part in the North Sea fisheries of England, as may be seen by the following tables:

QUANTITIES OF DEMERSAL FISHES, CLASSES, AND CERTAIN KINDS FROM THE NORTH SEA LANDED ON THE EAST COAST OF ENGLAND BY FIRST-CLASS STEAM LINERS IN THE FIRST AND LAST YEARS OF CERTAIN PERIODS.

Classes, species, and periods.	Catch (hundredweight) during—		Gain or loss.	
	First year.	Last year.	Hundredweight.	Per cent.
Demersal fishes:				
1903–1906	33,338	[a] 9,740	−23,648	− 70
1906–1912	[a] 9,740	20,678	+10,938	+112
Round fishes:				
1903–1906	21,898	7,973	−13,925	− 63
1906–1912	7,973	17,394	+ 9,421	+118
Flat fishes:				
1903–1906	10,197	1,688	− 8,509	− 83
1906–1912	1,688	3,265	+ 1,577	+ 93
Cod:				
1903–1906	12,451	5,555	− 6,896	− 55
1906–1912	5,555	15,031	+ 9,476	+170
Haddock:				
1903–1906	2,782	...	...	...
1906–1912	...	46	...	...
Plaice:				
1903–1906	51	...	...	...
1906–1912	...	...	...	...

[a] Landed in all England and Wales, but probably all on east coast.

AVERAGE CATCH PER DAY'S ABSENCE OF STEAM LINERS FISHING IN THE NORTH SEA FROM THE EAST COAST OF ENGLAND IN 1906 AND 1912, RESPECTIVELY.

Species.	Catch (hundredweight) during—		Gain.	
	1906	1912	Hundredweight.	Per cent.
Demersal fishes	14.78	18.28	3.50	23
Cod	8.43	11.32	2.89	34
Haddock	...	.01	...	...
Plaice	...	...	...	...

SUMMARY OF CONDITIONS IN THE NORTH SEA.

Summarizing the conditions of the fisheries of the North Sea, as shown by the examination of the English official reports, we find that since 1891 there has been a material decrease in the quantities of fishes caught, and that both round fishes and flat fishes have participated in this decrease. During this time there has been considerable change in the strength and composition of the fishing fleet, the most important of which was the substitution of the otter trawl for the beam trawl, which became practically complete as early as 1898. Since that time, at least, this apparatus has been the predominant means by which the fishery was conducted, and it catches about 90 per cent of the fish taken by all means by English vessels, and the

English trawlers take about 45 per cent of the demersal fish, and rather more than that portion of cod, haddock, and plaice taken by all nations in the North Sea.

Exact data respecting the activities and catch of this fleet, which are available since 1902 only, show that the average catch of demersal fishes, per voyage and per day's absence from port, has materially decreased between 1903 and 1912, and this decrease has occurred in both round fishes and flat fishes. There is, therefore, presumptive evidence of the depletion of the fisheries as a whole.

Cod, haddock, and plaice combined constitute about 80 per cent of the demersal fishes caught by English vessels in the North Sea, and they represent an almost equal proportion of the catch by all countries in those waters. Of these we find that the cod shows an increase in the total catch and in the averages per voyage and per day's absence, the only sign of depletion appearing in the decrease in the proportional catch of large fishes and the increase in the proportion of small ones.

The haddock shows indications of depletion in the heavy and consistent decrease in the total catch, and in the average catches per voyage and per day's absence. Statistically it shows but slight indications of overfishing in the ratios of the several sizes, but we believe this indication would be more pronounced if the standards of sizes had been maintained on equality with those of earlier years. The plaice, by every method of examination which the data will permit us to apply, shows unmistakable signs of depletion.

We believe, therefore, that there is overfishing in respect to both haddock and plaice, and that in consideration of its overwhelming predominance the otter trawl is responsible. The cod, being a rapacious, more nomadic fish, and less distinctly a bottom dweller, is not affected.

ICELAND.

The importance of the English steam-trawl fisheries in Iceland was second to that of the North Sea only in both 1906 and 1912, and the steam-line fishery in the region held first place in both years among the 14 regions enumerated in the reports. Practically no other method of fishing is pursued there by English vessels, and the trawlers took about 93 per cent of the total catch in 1906 and about 90 per cent in 1912.

In 1906 there were 1,579 and in 1912 there were 1,430 voyages by trawlers, a decrease of about 9 per cent, and the total number of days' absences decreased 11 per cent, from 35,039 days in 1906 to 30,919 days in 1912. The average duration of the voyages was nearly equal in the two years, being 22.2 days in 1906 and 21.6 days in 1912. The total catch of the trawlers and the average catch per trip are shown in the following tables:

TOTAL CATCH OF DEMERSAL FISHES, CLASSES, AND IMPORTANT KINDS BY ENGLISH STEAM TRAWLERS FISHING IN ICELAND WATERS IN 1906 AND 1912.

Classes and species.	Quantity (hundredweight).		Gain or loss.	
	1906	1912	Hundredweight.	Per cent.
Demersal fishes	1,549,502	1,439,774	− 108,728	− 7
Round fishes	1,266,248	1,233,396	− 32,852	− 2
Flat fishes	237,431	173,323	− 64,108	− 27
Cod	729,322	800,992	+ 71,670	+ 9
Haddock	414,241	310,136	− 104,105	− 25
Plaice	186,382	121,264	− 65,118	− 34

AVERAGE CATCH PER LANDING BY ENGLISH STEAM TRAWLERS FISHING IN ICELAND WATERS IN 1906 AND 1912.

Species.	Quantity (hundredweight).		Gain or loss.	
	1906	1912	Hundredweight.	Per cent.
Demersal fishes	1,051	1,120	+ 69	+ 6
Cod	461	560	+ 99	+ 21
Haddock	261	216	− 45	− 17
Plaice	118	84	− 34	− 28

The table of total quantities shows that there was a decrease in all fishes excepting the cod, but as is seen from a comparison of the table of average catches per voyage this was in part due to a decrease in fishing activity. Nevertheless, while there appears to have been an increase in the cod, as measured by the catch per unit of effort, there were equally considerable decreases in the haddock and plaice as measured by the same standard. In 1913 there was a further development of these tendencies, and while there was a heavy increase in the total catch of cod, due to increased fishing activity, there were material decreases in the total catches of haddock and plaice, and very heavy decreases in the average quantities per voyage, especially in plaice, of which but half as many were taken as in 1906.

PERCENTILE PROPORTIONS OF TRADE SIZES TO TOTAL OF ALL SIZES OF COD, HADDOCK, AND PLAICE FROM ICELAND, LANDED BY STEAM TRAWLERS IN QUADRENNIAL PERIODS BETWEEN 1906 AND 1912.

Species and sizes.	1906–1909	1909–1912
Cod:		
Large	67.3	57.3
Medium	19.4	21.9
Small	12.7	20.7
Haddock:		
Large	69.3	60.3
Medium	27.6	37.7
Small	3.0	1.9
Plaice:		
Large	53.9	36.6
Medium	43.8	57.7
Small	2.2	5.6

As shown in the foregoing table, the increase in the cod catch has been due to some extent to an increase in the relative quantities of the smaller sizes landed, and the decrease in the quantities of haddock and plaice, especially the latter, has occurred notwithstanding the marketing of an increased proportion of the small and medium sizes.

The statistical facts of this fishery, so far as they may be given weight on account of the brief period covered, point rather strongly to the possible depletion of the plaice fishery and to a less extent of the fishery for haddock. The cod, as appears to be the case everywhere, is unaffected.

In 1906 there were 346 voyages by English steam liners, aggregating 7,526 days of absence per port, and of an average duration of 21.7 days. In 1912 there were 521 voyages, entailing an aggregate absence of 10,268 days, and the average voyage occupied 19.6 days. The total catch of these steam liners and the average catch per voyage are shown in the following tables:

TOTAL CATCH OF DEMERSAL FISHES, CLASSES, AND IMPORTANT KINDS BY ENGLISH STEAM LINERS FISHING IN ICELAND WATERS IN 1906 AND 1912.

Classes and species.	Quantity (hundredweight).		Gain or loss.	
	1906	1912	Hundredweight.	Per cent.
Demersal fishes	111,248	162,241	+50,993	+ 45
Round fishes	20,826	82,859	+62,033	+297
Flat fishes	83,847	74,300	− 9,547	− 11
Cod	13,954	58,388	+44,434	+318
Haddock	175	659	+ 484	+276

AVERAGE CATCH PER LANDING BY ENGLISH STEAM LINERS FISHING IN ICELAND WATERS IN 1906 AND 1912.

Species.	Quantity (hundredweight).		Gain or loss.	
	1906	1912	Hundredweight.	Per cent.
Demersal fishes	321	311	−10	− 3
Cod	40	112	+72	+180
Haddock	.5	1	+ .5	+100

It will be seen that no plaice were taken in these fisheries, and the catch of haddock, the other species of particular significance in this inquiry, was negligible. The decrease in flat fishes is due to the halibut, the principal species of that class taken by the liners. There was a heavy increase in cod. Very few small fishes of any kind are taken on lines, as will appear from the following table:

PROPORTIONS OF TRADE SIZES TO TOTAL CATCH OF ALL SIZES OF COD AND HADDOCK FROM ICELAND LANDED BY ENGLISH STEAM LINERS IN QUADRENNIAL PERIODS BETWEEN 1906 AND 1912.

Species and sizes.	1906-1909	1909-1912
Cod:		
Large	99.6	97.7
Medium	.31	2.1
Haddock:		
Large	92.1	100.0
Medium	7.8	....

WHITE SEA.

The fishery by English vessels in this region was conducted solely by steam trawlers, and, considering steam vessels only, it ranked eighth in catch among the 14 enumerated regions in 1906 and sixth in 1912. In 1906 there were 41 voyages to the White Sea, aggregating 1,129 days, and with an average length of 27.5 days. In 1912 there were 212 voyages, an increase of 419 per cent, aggregating 5,490 days of absence from port, an increase of 386 per cent, and having an average length of 25.9 days, a slight decrease. There are no specific data available for years prior to 1906. The total catch of fishes, by classes and important species, is shown in the following table:

TOTAL CATCH OF DEMERSAL FISHES, CLASSES, AND IMPORTANT KINDS BY ENGLISH STEAM-TRAWL VESSELS FISHING IN THE WHITE SEA IN 1906 AND 1912.

Classes and species.	Quantity (hundredweight).		Gain.	
	1906	1912	Hundredweight.	Per cent.
Demersal fishes	45,330	210,636	165,306	364
Round fishes	6,083	95,813	89,730	1,310
Flat fishes	39,210	113,945	74,735	190
Cod	1,089	52,137	51,046	4,686
Haddock	4,480	40,297	35,917	799
Plaice	39,176	110,848	71,672	182

This fishery was originally undertaken primarily for plaice, which constituted over 86 per cent of the total catch in 1906, but while the quantity of this species had increased about 183 per cent in 1912 the catch of cod and haddock had increased more rapidly and plaice comprised less than 53 per cent of the combined catch of the three species in 1912. To eliminate the statistical effects of the increase in fishing activity and reduce the catches to the basis of units of effort expended in making them, the following table is presented:

AVERAGE CATCHES PER LANDING BY ENGLISH STEAM-TRAWL VESSELS FISHING IN THE WHITE SEA IN 1906 AND 1912.

Species.	Quantity (hundredweight).		Gain or loss.	
	1906	1912	Hundredweight.	Per cent.
Demersal fishes	1,105	993	−112	− 10
Cod	27	246	+219	+811
Haddock	109	190	+ 81	+ 74
Plaice	956	523	−433	− 45

It will be seen from this that the average catch of demersal fishes per voyage has decreased slightly, and of plaice, the principal species caught, heavily between 1906 and 1912. The average catches of cod and haddock have each increased, the former enormously. As the plaice is the highest-priced and most desirable fish of the three, the inference is that there was a deficiency of that species, which was made good in some measure by increased attention to the cod and haddock. This tendency appears to have been reasonably continuous throughout the period discussed. In 1913 there were but 108 voyages to the White Sea, and the average catch of the cod and plaice per voyage was about the same as in the preceding year, but there was a further increase of about 50 per cent in the average catch of haddock.

To determine whether there is any other indication of a depletion of the supply of these fishes, the following analysis has been made of the catch in respect to its composition by sizes during the two overlapping four-year periods for which information is available:

PROPORTION OF THE DIFFERENT TRADE SIZES OF COD, HADDOCK, AND PLAICE TO THE WHOLE OF THE THREE COMBINED, IN QUADRENNIAL PERIODS BETWEEN 1906 AND 1912.

Species and sizes.	1906–1909	1909–1912
Cod:	*Per cent.*	*Per cent.*
Large	11.8	9.0
Medium	22.9	55.1
Small	65.1	35.8
Haddock:		
Large	89.3	35.0
Medium	10.5	64.8
Small	.1	.1
Plaice:		
Large	28.5	30.6
Medium	71.3	69.2
Small	....	....

This throws but little light on the subject other than to show that the increases in the catches of cod and haddock were mainly in the medium sizes, and to warrant the inference that probably only the larger haddock were saved in the earlier period when the species was less energetically sought. The large plaice have slightly more than maintained their proportional importance.

Considering the facts developed and the brevity of the period which it is possible to discuss, we can draw no conclusions excepting the dubious one that the supply of plaice in the White Sea may not be sufficient for the maintenance of the fishery for that species on the scale which it has attained.

FAROE.

This region, which is the smallest of the four considered in this discussion of the English fisheries, lies about midway between the North Sea and Iceland. Its product, which is about 7 per cent of all demersal fishes landed in England, is greater than that of the White Sea but less than that of Iceland.

About 85 to 90 per cent of the fishes in this region are taken by steam trawlers, which made 1,085 trips in 1906 and 1,303 in 1912. The total number of days' absence was 17,215 in 1906 and 18,445 in 1912, the average duration of the voyages in the two years being 15.8 and 14 days respectively. The total catch and the average per voyage are shown in the following tables:

TOTAL CATCH OF DEMERSAL FISHES, CLASSES, AND IMPORTANT KINDS BY ENGLISH STEAM TRAWLERS FISHING ON FAROE GROUNDS, 1906 AND 1912.

Classes and species.	Quantity (hundredweight).		Gain or loss.	
	1906	1912	Hundredweight.	Per cent.
Demersal fishes	536,947	584,484	+47,537	+ 8
Round fishes	470,675	539,775	+69,100	+14
Flat fishes	30,231	20,155	−10,076	−33
Cod	245,364	341,704	+96,340	+39
Haddock	190,740	147,525	−43,215	−22
Plaice	4,346	989	− 3,357	−77

AVERAGE CATCH PER LANDING BY ENGLISH STEAM TRAWLERS FISHING ON FAROE GROUNDS, 1906 AND 1912.

Classes and species.	Quantity (hundredweight).		Gain or loss.	
	1906	1912	Hundredweight.	Per cent.
Demersal fishes	495	449	−46	− 9
Round fishes	434	414	−20	− 5
Flat fishes	28	15	−13	−44
Cod	226	262	+36	+15
Haddock	176	113	−63	−35
Plaice	4	.8	− 3.2	−80

The total catch of demersal fishes showed a slight improvement, but this was due to an increase in the intensity of the fishery. The quantity of plaice taken was insignificant, the principal flat fishes of the region being halibut and skates, the combined catch of which exhibited a large decrease both in the total and the average per voyage.

Cod and haddock are the principal species taken, and of these the cod, the more important, was caught in greater quantities, while the take of haddock diminished. An examination of the following table shows that the improvement in the yield of cod was due solely to an increase in the quantity of small and medium fish marketed, the large fish undergoing an actual quantitative decrease. The same trend is shown in the catch of haddock, in which there was an actual increase in the quantities of medium and small fish in the face of a falling off in the total catch of the species.

PROPORTION OF THE TRADE CATEGORIES TO TOTAL CATCHES OF COD AND HADDOCK TAKEN ON FAROE GROUNDS BY ENGLISH STEAM TRAWLERS IN QUADRENNIAL PERIODS FROM 1906 TO 1912.

Species and sizes.	1906–1909	1909–1912
Cod:	*Per cent.*	*Per cent.*
Large	39.2	21.8
Medium	36.1	31.2
Small	24.5	46.8
Haddock:		
Large	72.2	68.2
Medium	23.4	20.6
Small	4.2	11.1

In view of the relatively small importance of the line fishery, it is not considered necessary to discuss it more than in the presentation of the following table:

TOTAL CATCH OF DEMERSAL FISHES, CLASSES, AND IMPORTANT KINDS BY ENGLISH STEAM LINERS FISHING ON FAROE GROUNDS IN 1906 AND 1912.

Classes and species.	Quantity (hundredweight).		Loss.	
	1906	1912	Hundredweight.	Per cent.
Demersal fishes	81,662	41,461	40,201	49
Round fishes	48,963	27,416	21,547	44
Flat fishes	27,661	12,788	14,873	53
Cod	29,867	14,827	15,040	50
Haddock	462	114	348	75
Plaice	4	....	....	....

The Faroe fishery, as a whole, furnishes no data of value respecting the plaice, but making due allowance for the shortness of the period considered, the data available establish some presumption of a decrease in the haddock and a suspicion that there may be overfishing of the cod.

DEMERSAL FISHERIES OF SCOTLAND.

FISHING REGIONS.

The Scottish reports furnish but little specific data respecting the fishing regions, such distinctions as are made indicating merely the part of Scotland in which the fish are landed, the east coast, Orkney, and Shetland, and the west coast, respectively. The latter two are of practically no importance to the purposes of this report and are not discussed.

The major portion of the demersal fish caught in the Scottish fisheries are landed on the east coast; and as that is the region in which trawl fishing is of greatest importance, and as practically all fish taken in the North Sea by Scottish vessels are landed there, it is the only region which we have deemed it necessary to consider.

FISHERIES OF THE EAST COAST.

The statistics and the general information available for Scotland are not very satisfactory for the consideration of the effects of otter trawling on the fisheries, inasmuch as they lack, even to a greater extent than the earlier reports for England, that particularity of data which is necessary for a proper consideration of the subject. However, it is possible to trace some trend, and as this accords in general with that indicated in the English fisheries, it may be regarded, with some caution, as confirmatory of the conclusions formed respecting the latter.

In the following discussion the same historical periods and subperiods are considered, partly for the sake of uniformity with the discussion of the English data and partly because the forms of the statistics underwent some change in the years of demarcation, or because some change in the fishery became definitive in those years. For instance, 1898 is the first year concerning which it is known that all steam trawlers were using the otter trawl, which had gradually replaced the beam trawl; in 1904 there was a change in the classification of the fishes; and in 1906 there was a material change in the particularity of the statistics in respect to certain important fisheries. The effects of these changes have been eliminated as far as possible in the following pages, but their existence dictated the form of the more comprehensive digest found in the appendix and colored the form of final presentation of the data adduced.

THE CATCH AS A WHOLE.

The east coast was by far the most important producer of demersal fishes in Scotland, the catch of that region in 1891 being over 70 per cent of the total product of the country and in 1912 over 76 per cent.

The statistical history of the yield of the region is shown in the following table:

CATCHES OF DEMERSAL FISHES AND THE SEVERAL CLASSES ON THE EAST COAST OF SCOTLAND DURING THE FIRST AND LAST YEARS OF CERTAIN PERIODS.

Classes and periods.	Quantity (hundredweight) during—		Increase or decrease	
	First year.	Last year.	Hundredweight.	Per cent.
Demersal fishes:				
1891–1898	1,339,051	1,465,426	+ 126,375	+ 9
1898–1901	1,465,426	1,724,525	+ 259,099	+ 17
1901–1903	1,724,525	1,955,718	+ 231,193	+ 13
1903–1906	1,955,718	2,299,311	+ 343,593	+ 17
1906–1912	2,299,311	2,544,897	+ 245,586	+ 10
1891–1912	1,339,051	2,544,897	+1,205,846	+ 90
Round fishes: [a]				
1891–1898	1,127,452	1,267,938	+ 140,486	+ 12
1898–1901	1,267,938	1,413,385	+ 145,447	+ 11
1901–1903	1,413,385	1,668,275	+ 254,890	+ 18
1903–1906	1,668,275	1,979,205	+ 310,930	+ 18
1906–1912	1,979,205	2,179,555	+ 200,350	+ 10
1891–1912	1,127,452	2,179,555	+1,052,103	+ 93
Flat fishes: [a]				
1891–1898	94,745	101,460	+ 6,715	+ 7
1898–1901	101,460	170,013	+ 68,553	+ 67
1901–1903	170,013	164,295	− 5,718	− 3
1903–1906	164,295	139,282	− 25,013	− 15
1906–1912	139,282	135,063	− 4,219	− 3
1891–1912	94,745	135,063	+ 40,318	+ 42
Unclassified fishes: [b]				
1891–1898	84,347	47,373	− 36,974	− 43
1898–1901	47,373	81,182	+ 33,809	+ 71
1901–1903	81,182	61,265	− 19,917	− 24
1903–1906	61,265	105,256	+ 43,991	+ 71
1906–1912	105,256	119,810	+ 14,554	+ 13
1891–1912	84,347	119,810	+ 35,463	+ 42
Skates:				
1891–1898	32,506	48,655	+ 16,149	+ 49
1898–1901	48,655	59,945	+ 11,290	+ 23
1901–1903	59,945	61,883	+ 1,888	+ 3
1903–1906	61,883	75,568	+ 13,735	+ 22
1906–1912	75,568	110,469	+ 34,901	+ 46
1891–1912	32,506	110,469	+ 77,963	+239

[a] Excluding fishes classified after 1903.

[b] Including fishes classified after 1903.

From the foregoing table it is seen that there has been a constant and fairly uniform increase in the catch of demersal fishes, amounting in the aggregate to about 90 per cent from 1891 to 1912, and that both relatively and quantitatively this has been in major part produced by the constant increase in the catch of round fishes, which in the same period increased 93 per cent in quantity.

Flat fishes registered an increase of 42 per cent for the period, due mainly to a heavy increase from 1898 to 1901, after which there was a decrease to and including 1912. Unclassified fishes, including those classified after 1903, fluctuated until 1903, but increased afterwards until the total at the end of the period was 42 per cent greater than in 1891. The catch of skates increased heavily and continuously throughout the period.

Cod, haddock, flounder, plaice and brill, and halibut are the most important species of demersal fishes landed on the east coast of Scotland, and these kinds combined constituted 55.8 per cent of the landings of demersal fishes of all Scotland in 1891, and about 53.3 per cent in 1912. Cod and haddock landed on the east coast in 1891 constituted nearly 61 per cent of Scottish round fishes and in 1912 nearly 57 per cent. In 1891 the flat fishes enumerated comprised about 43 per cent, and in 1912, 25 per cent of the country's landing of flat fishes. Furthermore, the catch of each of these species on the east largely exceeds the catch in all other regions. For these reasons, it is necessary to consider these fishes only in discussing the fluctuations of the fishery.

CATCH PER ANNUM AT THE BEGINNING AND ENDING OF CERTAIN PERIODS OF EACH OF THE MORE IMPORTANT SPECIES OF DEMERSAL FISHES LANDED ON THE EAST COAST OF SCOTLAND.

Species and periods.	Quantity (hundredweight) during—		Increase or decrease.	
	First year.	Last year.	Hundredweight.	Per cent.
Cod:				
1891-1898	310,020	429,431	+119,411	+ 38
1898-1901	429,431	353,506	− 75,925	− 17
1901-1903	353,506	454,527	+101,021	+ 28
1903-1912	454,527	833,636	+379,108	+ 83
1891-1912	310,020	833,636	+523,616	+168
Haddock:				
1891-1898	672,156	701,514	+ 29,358	+ 4.3
1898-1901	701,514	795,883	+ 94,369	+ 13
1901-1903	795,883	962,122	+166,239	+ 14
1903-1906	962,122	1,027,988	+ 65,866	+ 68
1906-1912	1,027,988	853,710	−174,278	− 16
1891-1912	672,156	853,710	+181,554	+ 27
Halibut:				
1891-1898	7,850	19,000	+ 11,150	+142
1898-1901	19,000	30,377	+ 11,337	+ 59
1901-1903	30,377	27,350	− 3,027	− 9.9
1903-1906	27,350	34,168	+ 6,818	+ 24
1906-1912	34,168	43,758	+ 9,590	+ 28
1891-1912	7,850	43,758	+ 35,908	+ 45
Flounders, plaice, and brill:				
1891-1898	64,929	59,276	− 5,653	− 8.7
1898-1901	59,276	112,070	+ 52,794	+ 89
1901-1903	112,070	101,710	− 10,360	− 9.2
1903-1906	101,710	66,861	− 34,849	− 34
1906-1912	66,861	47,702	− 19,159	− 28
1891-1912	64,929	47,702	− 17,227	− 26
Skate:				
1891-1898	32,506	48,655	+ 16,149	+ 49
1898-1901	48,655	59,945	+ 11,290	+ 25
1901-1903	59,945	61,883	+ 1,938	+ 3.2
1903-1906	61,883	75,568	+ 13,685	+ 22
1906-1912	75,568	110,469	+ 34,901	+ 46
1891-1912	32,506	110,469	+ 77,963	+239

From the foregoing it is apparent that both the cod and haddock, but especially the former, landed on the east coast of Scotland, exhibited material increases in total quantity between 1891 and 1912, and this increase occurred in all of the periods considered excepting from 1898 to 1901 in the case of the cod, and 1906 to 1912 in the case of the haddock. Halibut increased for the whole period and showed a recession only between 1901 and 1903, while flounder, plaice, and brill decreased on the whole and showed improvement between 1901 and 1903 only. Skates increased constantly and consistently throughout the entire period considered. The increase in round fishes previously noted is therefore due principally to cod, but in a considerable part to haddock also. The increase in flat fishes is due mainly to the improved catch of halibut.

STEAM TRAWLERS.

In 1891 over 98 per cent and in 1912 over 95 per cent of the steam trawlers of Scotland hailed from the east coast. The composition of the fleet prior to 1898 is not known, but it probably contained some beam trawlers, but in 1898, and thenceforth to the present time, all of the vessels were equipped with the more efficient otter trawl. The statistical history of this fleet is shown in the following table:

NUMBER OF SCOTCH AND FOREIGN STEAM OTTER TRAWLERS ON THE EAST COAST OF SCOTLAND DURING THE FIRST AND LAST YEARS OF CERTAIN PERIODS.

Period.	Number during—		Increase or decrease.	
	First year.	Last year.	Number.	Per cent.
1891–1898	60	144	+ 84	+123
1898–1901	144	254	+110	+ 77
1901–1903	254	273	+ 19	+ 7
1903–1906	273	261	− 12	− 4
1906–1912	261	306	+ 45	+ 17
1891–1912	60	306	+246	+410

TOTAL CATCH BY STEAM TRAWLERS ON THE EAST COAST OF SCOTLAND IN THE FIRST AND LAST YEARS OF CERTAIN PERIODS.

Classes and periods.	Quantity (hundredweight) during—		Increase or decrease.	
	First year.	Last year.	Hundredweight.	Per cent.
Demersal fishes:				
1891–1898	332,950	778,731	+ 445,781	+133
1898–1901	778,731	1,310,907	+ 532,176	+ 68
1901–1903	1,310,907	1,543,679	+ 232,772	+ 17
1903–1906	1,543,679	1,837,146	+ 293,467	+ 19
1906–1912	1,837,146	1,934,337	+ 97,191	+ 5
1891–1912	332,950	1,934,337	+1,601,387	+480
Round fishes:				
1891–1898	212,020	660,609	+ 448,589	+211
1898–1901	660,609	1,079,526	+ 418,917	+ 63
1901–1903	1,079,526	1,322,463	+ 242,937	+ 22
1903–1906	1,322,463	1,585,889	+ 263,426	+ 19
1906–1912	1,585,889	1,683,215	+ 97,326	+ 6
1891–1912	212,020	1,683,215	+1,471,195	+693
Flat fishes:				
1891–1898	80,492	69,183	− 11,309	− 14
1898–1901	69,183	112,998	+ 43,815	+ 63
1901–1903	112,998	129,175	+ 16,177	+ 14
1903–1906	129,175	104,417	− 24,758	− 19
1906–1912	104,417	84,413	− 20,004	− 19
1891–1912	80,492	84,413	+ 3,921	+ 4

The catch of demersal fish by steam trawlers increased constantly during the period from 1891 to 1912, and at the end was 480 per cent greater than at the beginning. This was made up mainly of round fishes, taking into consideration those species only which were so classified in all years. If to these were added the species which were classified after 1903, the increase would be practically entirely among the round fishes.

The catch of flat fishes fluctuated, but there was a practical parity between 1891 and 1912, notwithstanding a heavy increase in the fleet shown in another place in this report. The history of the catch of the principal species of round fishes and flat fishes is shown in the following table:

TOTAL CATCH OF IMPORTANT SPECIES OF FISHES BY STEAM OTTER TRAWLERS ON THE EAST COAST OF SCOTLAND IN THE FIRST AND LAST YEARS OF CERTAIN PERIODS.

Species and periods.	Quantity (hundredweight) during—		Increase or decrease.	
	First year.	Last year.	Hundredweight.	Per cent.
Cod:				
1891-1898	33,589	165,593	+132,004	+ 392
1898-1901	165,593	203,099	+ 37,506	+ 28
1901-1903	203,099	311,928	+108,819	+ 53
1903-1906	311,928	462,476	+150,448	+ 48
1906-1912	462,476	571,694	+109,222	+ 23
1891-1912	33,589	571,694	+538,105	+ 1,062
Haddock:				
1891-1898	157,059	461,208	+304,149	+ 193
1898-1901	461,208	706,403	+245,195	+ 53
1901-1903	706,403	826,122	+119,719	+ 16
1903-1906	826,122	868,137	+ 42,015	+ 5
1906-1912	868,137	469,099	−399,038	− 45
1891-1912	157,059	469,099	+312,040	+ 198
Halibut:				
1891-1898	34	1,520	+ 1,486	+ 4,370
1898-1901	1,520	6,665	+ 5,145	+ 338
1901-1903	6,665	7,399	+ 734	+ 11
1903-1906	7,399	12,679	+ 5,280	+ 71
1906-1912	12,679	8,235	− 4,444	− 34
1891-1912	34	8,235	+ 8,201	+24,120
Flounders, plaice, and brill:				
1891-1898	51,084	44,595	− 6,489	− 12
1898-1901	44,595	93,868	+ 49,273	+ 110
1901-1903	93,868	86,703	− 7,165	− 12
1903-1906	86,703	53,711	− 32,992	− 38
1906-1912	53,711	35,000	− 18,711	− 34
1891-1912	51,084	35,000	− 16,084	− 31
Skate:				
1891-1898	7,871	11,092	+ 3,221	+ 40
1898-1901	11,092	25,639	+ 14,547	+ 131
1901-1903	25,639	33,342	+ 7,903	+ 30
1903-1906	33,342	40,707	+ 7,365	+ 22
1906-1912	40,707	49,831	+ 9,124	+ 22
1891-1912	7,871	49,831	+ 41,959	+ 533

Cod and haddock, particularly the former, provided the major part of the recorded increase in round fishes, but their relative importance to the total catch of round fishes changed materially. In 1891 cod constituted about 16 per cent of trawled round fishes, and in 1912 over 33 per cent, while the proportion of haddock fell from 75 per cent to about 28 per cent. It appears from this that, considering the increase in the fishing power of the trawl fleet, there was either a depletion of the haddock or the vessels resorted to other grounds, which would imply, although not positively indicate, the same thing. A decrease in haddock would require increased attention to other species, e. g., the cod, to maintain the productiveness of the fishery. This is further elucidated in considering the average catch of the trawlers.

In the case of flat fishes, halibut, which were of no importance in the catch in 1891, increased to almost 10 per cent of the whole class in 1912, while the category of flounder, plaice, and brill, which comprised over 60 per cent in 1891, was reduced to about 42 per cent in 1912. This leads to the same assumptions as in the case of the cod and haddock. In other words, the most important fishes in 1891 showed signs of depletion in 1912.

The average catch per vessel probably furnishes the best available criterion for comparison of the condition of the fishery in the several periods, and these data are tabulated below. The average per voyage and per days' absence can not be computed for lack of data.

AVERAGE CATCH PER ANNUM PER STEAM OTTER TRAWLER ON THE EAST COAST OF SCOTLAND DURING THE FIRST AND LAST YEARS OF CERTAIN PERIODS.

Classes and periods.	Quantity (hundredweight) during—		Increase or decrease.	
	First year.	Last year.	Hundredweight.	Per cent.
Demersal fishes:				
1891-1898	5,549	5,407	− 142	− 2
1898-1901	5,407	5,161	− 246	− 4
1901-1903	5,161	5,654	+ 493	+ 9
1903-1906	5,654	7,038	+1,384	+24
1906-1912	7,038	6,321	− 717	−10
1891-1912	5,549	6,321	+ 772	+13
Round fishes:				
1891-1898	3,533	4,587	+1,054	+29
1898-1901	4,587	4,250	− 337	− 7
1901-1903	4,250	4,844	+ 594	+13
1903-1906	4,844	6,076	+1,234	+25
1906-1912	6,076	5,500	− 576	− 9
1891-1912	3,533	5,500	+1,967	+55
Flat fishes:				
1891-1898	1,340	480	− 860	−64
1898-1901	480	444	− 36	− 7
1901-1903	444	473	+ 29	+ 6
1903-1906	473	400	− 73	−15
1906-1912	400	275	− 125	−31
1891-1912	1,340	275	−1,065	−79

The average catch per steam trawler in respect to demersal fishes fluctuated irregularly between 1891 and 1912 but exhibited a net increase of about 13 per cent. The total yield of the fishery, therefore, a little more than kept pace with the increase in the number of vessels but did not increase in proportion to the probable fishing power as measured by the increase in average tonnage and general efficiency.

Such improvement in the average yield as has been noted was due to round fishes alone, the average yield of that class in 1912 having increased about 55 per cent. Flat fishes in 1912 exhibited a loss of 79 per cent as compared with 1891, and the decrease was continuous between those years with the exception of a small increase between 1901 and 1903.

AVERAGE CATCH OF CERTAIN SPECIES PER ANNUM PER STEAM OTTER TRAWLER ON THE EAST COAST OF SCOTLAND DURING THE FIRST AND LAST YEARS OF CERTAIN PERIODS.

Species and periods.	Quantity (hundredweight) during—		Increase or decrease.	
	First year.	Last year.	Hundredweight.	Per cent.
Cod:				
1891-1898	559	1,149	+ 590	+ 105
1898-1901	1,149	799	− 350	− 30
1901-1903	799	1,142	+ 343	+ 43
1903-1906	1,142	1,771	+ 629	+ 55
1906-1912	1,171	1,864	+ 93	+ 5
1891-1912	559	1,864	+1,305	+ 233
Haddock:				
1891-1898	2,617	3,202	+ 585	+ 22
1898-1901	3,202	2,781	− 421	− 13
1901-1903	2,781	3,027	+ 246	+ 9
1903-1906	3,027	3,330	+ 303	+ 10
1906-1912	3,330	1,533	−1,797	− 54
1891-1912	2,617	1,533	−1,084	− 41
Halibut:				
1891-1898	.56	10	+ 9.5	+1,696
1898-1901	10	26	+ 16	+ 160
1901-1903	26	27	+ 1	+ 4
1903-1906	27	48	+ 21	+ 77
1906-1912	48	26	− 22	− 45
1891-1912	.56	26	+ 25	+4,542
Flounders, plaice, and brill:				
1891-1898	851	309	− 542	− 64
1898-1901	309	369	+ 60	+ 20
1901-1903	369	317	− 52	− 14
1903-1906	317	205	− 112	− 35
1906-1912	205	114	− 91	− 44
1891-1912	851	114	− 737	− 86
Skate:				
1891-1898	131	77	− 54	− 41
1898-1901	77	100	+ 23	+ 30
1901-1903	100	122	+ 22	+ 22
1903-1906	122	156	+ 34	+ 28
1906-1912	156	162	+ 6	+ 4
1891-1912	131	162	+ 31	+ 23

An analysis of the foregoing table shows that the cod was the chief contributor to the increase in round fishes, increasing 233 per cent. This species supplanted the haddock in 1912 as the most important round fish, although the latter maintained its quantitative supremacy in decreasing ratio to 1906. The average catch of haddock underwent various vicissitudes of increase and decrease, but showed a net decrease of 41 per cent for the period as a whole. Eliminating the subperiod 1906 to 1912, there was a net increase of

27 per cent, but even so its importance as compared with the cod showed a marked recession.

The category of flounder, plaice, and brill was the most important element in the decrease of flat fishes, falling off almost continuously until in 1912 the average quantity taken by trawler was but 14 per cent of that of 1891. So far as trawlers are concerned, this category may be regarded as practically composed of plaice, as the quantity of the other two species comprised hardly more than 10 per cent in 1906 and probably less than that in earlier years.

It is evident, then, that, certainly with the plaice and probably with the haddock, the two essentially trawl-caught fish, the catch per trawler shows significant reduction, notwithstanding the presumably increased efficiency of the vessels as measured by their increased size. As has been previously suggested in the discussion of the total catch by trawlers, this appears to mean that there is a depletion of the supply of these fishes on the grounds frequented by these vessels, or that the vessels are fishing to an increasing extent on grounds little resorted to in the earlier years of the period discussed. The possible change in grounds in favor of the cod and to the detriment of the haddock and plaice catch can hardly, if it occurred, have any other reason than the depletion of the supply of the latter two species on the grounds previously resorted to, for the plaice has always been a more valuable species than the cod, and the haddock, while of approximately equal value to the cod in 1908 and previously, is now more valuable.

The halibut is more valuable than any of the other fishes mentioned, but the quantitative increase is not sufficient to offer an explanation of a change of fishing grounds, although the fact of the increase probably indicates that such change has occurred. There are no specific data to show where the fleet fished in the several years.

The only other basis on which the foregoing comparisons could be made while eliminating the statistical effects of changes in the intensity of fishing activity would be through the consideration of the catch per landing. The data necessary are not available for the east coast as a whole, but they are recorded for the trawlers fishing out of the ports of Montrose, Fraserburgh, and Aberdeen after 1905, which comprised nearly 80 per cent of the Scottish steam trawl fleet. This period is too short for a comparison of much value to the purposes of this report, but the data may be used to test in a measure the validity of the presumptions and discussions. The following table compares the percentile increases and decreases in the average catches of the trawlers from those ports per vessel and per landing:

Increase or Decrease in Quantity per Vessel and per Landing of Fishes Landed at Montrose, Fraserburgh, and Aberdeen by Steam Trawlers in 1912, as compared with 1906.

Species.	Average catch per vessel.		Average catch per landing.	
	Hundredweight.	Per cent.	Hundredweight.	Per cent.
Demersal fish	−305	− 4.3	− 6.0	− 4.3
Cod	+198	+10.4	+ 4.1	+10.6
Haddock	−697	−21.9	−13.8	−21.8
Halibut	− 17	−36.0	− .3	−35.9
Plaice	− 27	−18.0	− .5	−17.3
Skate	+ 10	+ 5.5	+ .2	+ 5.5

The number of landings per vessel was practically the same in the two years and, therefore, the table shows an almost exact parallelism in the percentile changes calculated on the two bases and tends to confirm the general validity of deductions based on the average catch per vessel. It is quite probable that in other years the results would not be in such exact accord, but it is equally probable that the divergence would not be sufficient to change the trend of the whole series of apparent facts.

It has been seen that the landings of cod by steam trawlers on the east coast of Scotland have shown a practically continuous heavy increase in both aggregate quantity and the average per vessel during the period from 1891 to 1912. Haddock increased in total, but decreased in the average catch per trawler, while plaice displayed a practically continuous decrease in both.

There are no data which will show the proportions of the several trade sizes of these species for the east coast as a whole, but they are available for Aberdeen for the period from 1906 to 1912; and as the great majority of the steam trawlers hail from that port, an analysis of the statistics is of interest.

The records of the landings at Aberdeen indicate the general regions in which the fish were taken, and as the great majority of the voyages and but a slightly less proportion of the catch were made on the "east coast grounds," near Aberdeen, and on the northern grounds (Orkney and Shetland), the data respecting these two regions throw some light on the change of conditions of the fishery during the comparatively short period from 1906 to 1912.

The following tables compare the percentile ratios and the quantities of cod, haddock, and plaice of the several sizes taken by steam trawlers at Aberdeen in 1906 to 1908, inclusive, and 1910 to 1912, inclusive, respectively:

AVERAGE ANNUAL CATCH OF CERTAIN FISHES, IN HUNDREDWEIGHTS, PER STEAM OTTER TRAWLER AT ABERDEEN, SCOTLAND, 1906 TO 1908 AND 1910 TO 1912, RESPECTIVELY.

Species and sizes.	"East coast grounds."		"Northern grounds."	
	1906–1908	1910–1912	1906–1908	1910–1912
Cod:				
Large and medium	8.0	5.9	17.4	26.4
Small (codling)	4.9	7.2	15.1	31.0
Total	12.9	13.1	32.5	57.4
Haddock:				
Large	5.2	3.0	43.0	35.8
Medium	5.2	3.1	20.0	15.6
Small	21.1	16.6	42.3	26.0
Total	31.5	22.7	105.3	77.4
Plaice:				
Large	.08	.05	.51	.33
Medium	1.30	1.13	2.67	.70
Small	.18	.60	.15	.06
Total	1.56	1.78	3.33	1.09

AVERAGE ANNUAL PERCENTILE RATIOS OF SIZES OF CERTAIN FISHES TO TOTAL OF THE SAME SPECIES LANDED BY STEAM OTTER TRAWLERS AT ABERDEEN, SCOTLAND, IN 1906 TO 1908 AND 1910 TO 1912, RESPECTIVELY.

Species and sizes.	"East coast grounds."		"Northern grounds."	
	1906–1908	1910–1912	1906–1908	1910–1912
Cod:				
Large and medium	61.9	44.7	54.5	45.9
Small (codling)	38.1	55.3	45.5	54.1
Haddock:				
Large	16.6	14.2	41.3	46.4
Medium	16.2	13.8	18.9	20.1
Small	67.2	72.0	39.8	33.5
Plaice:				
Large	5.1	2.6	20.8	4.2
Medium	82.7	64.4	72.3	88.0
Small	12.2	33.0	6.8	7.8

On the "east coast grounds," which include the fishing grounds nearest to Aberdeen, to which the voyages were shortest, most frequent, and most numerous, and on which the catch per voyage was least, there has been an increase in the proportionate quantity of the small sizes of all three species. In the case of the cod there have been a decrease in the actual quantity of large cod and an increase in the small, the species as a whole remaining stationary. In the haddock both the total and the several sizes have decreased in average catch, with small decreases in the proportion of large and medium sizes, and a corresponding increase in the proportion of small ones. In the plaice there was an increase in the catch, owing solely to a material increase in the small, the take of the other sizes having decreased both quantitatively and proportionately to the whole.

On the "northern grounds" both large and small cod increased very materially, but the latter, which formed but 45 per cent of the catch in 1906 to 1908, constituted 54 per cent in 1909 to 1912. All sizes of haddock decreased, but the large and medium categories were both of proportionately greater importance in the catch in 1909 to 1912 than in the earlier years, while the ratio of small fish to total haddock declined. There was a heavy quantitative decline in all sizes of plaice, but relatively the small, and especially the medium size, increased at the expense of the large fish.

It appears from the foregoing that all of these fish, excepting the cod on the northern grounds, show signs of depletion either in a quantitative decrease in the catch of large sizes of fish, or a relatively greater catch of small sizes accompanied by a stationary or decreasing catch of the species as a whole. The evidence is most emphatic respecting the plaice, less conclusive as regards the haddock, and contradictory in the case of the cod. The increase in the quantity and ratio of the catch of small cod on the northern grounds suggests increased attention to this species to compensate for some deficiency in other kinds, e. g., haddock and plaice. The period covered by this analysis is too short for the conclusions to carry great weight by themselves, but they are of value when considered with the deductions from other data previously examined.

SCOTCH LINE FISHERIES.

The number of line fishing boats and vessels on the east coast of Scotland can not be definitely determined from the reports, and the only data showing the extent of the fishery are those pertaining to the length of lines.

LENGTH OF LINES FISHED BY VESSELS OF ALL CLASSES ON THE EAST COAST OF SCOTLAND DURING THE FIRST AND LAST YEARS OF CERTAIN PERIODS.

Periods.	Length, in 1,000 yards.		Decrease.	
	First year.	Last year.	1,000 yards.	Per cent
1898–1901	54,989	46,320	8,669	15
1901–1903	46,320	40,230	6,090	13
1903–1906	40,230	39,047	1,183	3
1906–1912	39,047	32,888	6,159	16
1898–1912	54,989	32,888	22,101	40

The data are not available prior to 1898, but since then there has been a continuous and conspicuous decrease in the length of line. The smallest decrease occurred between 1903 and 1906, the only period in which the number of steam otter trawlers waned.

Unfortunately the various classes of lines, "great," "small," and "hand," while all exhibiting heavy decreases, did not maintain their ratios to one another, and as they differ materially in their fishing power unit of length and as the catch of each was not separately recorded in the reports, it is unsafe to venture conclusions on the data available.

Steam liners use more nearly one class of gear, great lines; and as, so far as the statistics show, the other kinds of lines were used in negligible quantities, the statistics of those vessels are more nearly comparable in the several years, and afford the only basis for a comparative study of the intensity of the line fishery.

LENGTH OF TRAWL LINES FISHED BY STEAM VESSELS ON THE EAST COAST OF SCOTLAND DURING THE FIRST AND LAST YEARS OF CERTAIN PERIODS.

Periods.	Length, in 1,000 yards.		Increase.	
	First year.	Last year.	1,000 yards.	Per cent.
1898–1901	1,474	3,195	1,721	117
1901–1903	3,195	3,542	347	11
1903–1906	3,542	6,050	2,508	71
1906–1912	6,050	11,702	5,652	93
1898–1912	1,474	11,702	10,228	693

While the total length of lines fished on the east coast of Scotland was decreasing, the length of the lines used by steam vessels was steadily and rapidly growing, but it was not until after 1903 that it exceeded 10 per cent of the total. In 1906 it comprised over 15 per cent, and in 1912 about 35 per cent. This kind of line was undoubtedly more effective per unit of length than that fished from the sailing vessels, and the catch of steam liners should be separately considered, but unfortunately the landings of these vessels were not separately recorded until 1906.

TOTAL QUANTITIES OF DEMERSAL FISHES TAKEN BY STEAM LINERS ON THE EAST COAST OF SCOTLAND IN 1906 AND 1912, RESPECTIVELY.

Classes and species.	1906	1912	Gain.	
			Hundredweight.	Per cent.
	Hundredweight.	*Hundredweight.*		
Total demersal fishes	162,195	255,414	93,219	57
Round fishes	109,481	161,679	52,198	48
Flat fishes	20,836	35,047	14,211	68
Skate	31,567	57,956	26,389	83
Unclassified	[a] 311	[a] 732	421	138
Cod	52,047	61,291	9,244	17
Haddock	114	345	231	202
Halibut	20,836	35,044	14,208	68

[a] Includes fishes classified since 1903.

There is here shown a percentile increase in the total catch of all categories and important species of demersal fishes, greatest among the unclassified fishes in respect to general categories and in haddock among the specific kinds. As this increase occurred pari passu, with a heavy increase in fishing activity or power, any significance which the facts presented may possess can be shown only by reducing the data of the two years to a comparative basis.

Two standards of fishing activity suggest themselves—the length of line employed in the respective years and the number of landings, but the two sets of results obtained by reducing the total catch to the average per 1,000 yards of line and the average per landing at those ports in which both are obtainable are contradictory and unreconcilable on any basis of which we have been able to conceive. This throws doubt on any deductions which might be drawn in respect to the data pertaining to the east coast steam liners as a whole. The uncertainties as to the lengths of the voyages on the one hand and to the character of the lines fished on the other make a further discussion futile, and the subject is mentioned here merely to show that it has been considered.

CHANGES IN THE UNCLASSIFIED FISHES.

The Scottish reports distinguish between two general groups of demersal fishes, classified and unclassified, the former including round fishes, flat fishes, and skates. The classified fishes embrace all of the more important kinds, which in most cases are separately designated, while the unclassified fish comprise a miscellaneous lot not separately listed and of minor importance in both quantity and value.

Until 1903 there were but 11 or 12 species in the classified lists, but in 1904 a number of species were transferred from the unclassified category, the total quantity of which was thereafter somewhat reduced to the benefit of the other categories. These changes are in themselves significant, but when accompanied by an increase in the ratio of unclassified to demersal fishes as a whole they indicate that the supply of classified fishes is unequal to the demand; and when the catch of certain species, as for instance the haddock and the plaice, exhibit a falling off, as has been shown in preceding pages, it means not that the commercial incentive to catch them has been lessened, but that the supply is insufficient.

This subject need not be considered further here than to say that since 1904, when the unclassified fishes were reduced by transfer, their ratio to all demersal fishes has increased from 0.5 per cent to 4.2 per cent in 1906, 4.9 per cent in 1910, and 4.6 per cent in 1912.

SUMMARY, EAST COAST OF SCOTLAND.

On the east coast of Scotland demersal fishes and round fishes both showed a continuous increase in the quantities landed from 1891 to 1912, and flat fishes increased until 1901, after which they decreased. These increases are due largely, if not wholly, to the development of steam trawling, which was responsible for about 25 per cent of the catch in 1891, 75 per cent in 1901, and about the same in 1912. The total catch of the trawlers, therefore, follows the same course, although the increases are heaviest between 1891 and 1901, when the fleet was developing most rapidly.

Neither the average length of the voyages nor the number of days' absence in the several years are known, and the only basis for the determination of the catch per unit of effort is the catch per annum per trawler. With some fluctuations this has shown an increase in respect to both demersal fishes as a whole and round fishes, and an almost continuous and material decrease in flat fishes. As has been shown elsewhere, this does not furnish a very satisfactory basis for comparison, as the effects of vessels lying idle for indeterminate and possibly important periods are not eliminated.

As in England, cod, haddock, and plaice are the most important species, and of these the latter is recorded in combination with two other species, neither of which, however, is quantitatively of much relative importance. Of these the cod has almost continuously increased in the average catch per vessel, and the net gain from 1891 to 1912 was large. The haddock has fluctuated, but in most years the average catch per vessel was higher than in 1891, although a heavy fall in 1912 caused a net decrease of 41 per cent for the entire period. The plaice, including the flounder and the brill, has decreased almost continuously, and the catch of 1912 was but 14 per cent of that of 1891. At a few ports where the number of landings has been given in later years, the average catches per voyage in 1912, as compared with 1906, showed an increase of 10 per cent in cod, a decrease of nearly 22 per cent in haddock, and a decrease of 17 per cent in plaice. As to the proportions of the several sizes of these fishes, data are available for the landings at Aberdeen, whence hail the majority of the trawlers, but for recent years only. The catch on the "east coast grounds" in near-by portions of the North Sea exhibited an increase in the proportionate quantity of the small sizes of all three species. From the region of Orkney and Shetland, on the northwest border of the North Sea, large cod and plaice decreased proportionately to the whole, while large and medium haddock increased somewhat. While all of the foregoing applies to fish landed on the east coast of Scotland from all regions, most of them came from the North Sea, concerning which, it may be said, therefore, that there is strong evidence of a depletion of the plaice and some evidence of a falling off in the haddock, the two most distinctly trawl-caught fish.

SUMMARY AND CONCLUSIONS.

1. Otter trawls do not destroy the spawn of the commercially important demersal fishes, all of which have pelagic or floating eggs.

2. Otter trawls do not seriously disturb the bottom over which they are fished nor materially denude it of the organisms which directly and indirectly serve as food for commercial fishes.

3. The investigations conducted by the Bureau of Fisheries indicated that during 1913 trawling interfered but little with line fishing and caused practically no damage to the trawl lines. From the nature of the two fisheries, however, it is believed both can not be extensively conducted on the same grounds without resultant accidental damage to or interference with the lines, especially in foggy weather.

4. Otter trawls as compared with lines take a much larger proportion of commercial fishes too small to market. From January to May 3 per cent of the cod and 11 per cent of the haddock, and from June to December 40 per cent of the cod and 38 per cent of the haddock were unmarketably small, while the lines caught practically no such fish. These proportions were fully maintained in the respective classes of vessels fishing at the same season on the same grounds. These young fish are practically all destroyed.

5. Otter trawls as compared with trawl lines market a much larger proportion of small fish, and, therefore, they not only destroy more small fish not utilized, but are biologically more wasteful, by reason of the smaller size of the marketable fish. As, however, a large proportion of these smaller fish would undoubtedly die or be destroyed under natural conditions before reaching the large or medium size, the effects on the total supply of fish are less to a conceivable, but at present indeterminable, degree than the data presented would indicate.

6. Practically the only food fish which the otter trawl has added to the present yield of the fisheries on the banks is the "sole," of which about 600,000 pounds were caught in 1913. This is equal to about three times the quantity of hake, 36 per cent of the cod, and 5 per cent of the haddock, or about 4 per cent of the three combined marketed by the trawlers. On the other hand, it is estimated that this is less than one-third of the weight of the immature cod, haddock, and hake destroyed by otter trawls. The trawlers have not added greatly to the food supply by the introduction of fishes not previously taken in quantities by the liners. They may have conferred some benefit on the consumer by catching and marketing

larger quantities of the smaller and cheaper fishes of the cod family, provided, of course, that this does not induce the depletion of the ultimate supply. Both trawlers and liners catch considerable quantities of edible species for which they have failed to develop a market.

7. There is but little evidence to show that the introduction of the otter trawl in the American fisheries has had any material effect in keeping down the price of fish. Since 1898 there has been a gradual, although fluctuating, increase in the price received by the fishermen for all kinds of fish. The haddock has increased proportionately less than the other demersal fishes and since 1908 has kept close to or below the level of that year, and this is probably, to no small extent, due to the large quantities of small and cheaper fish landed by the trawlers. The catch of the American trawlers, however, is too small in proportion to the total production of demersal fisheries to have a material effect on prices, and we have therefore examined the price statistics of England to determine what light they shed on the subject. We find that while, apparently, the otter trawl reduced the cost of production of fish for a number of years after it become paramount in the fishery of that country, it did it to some extent by reducing the standards of size, and that recently there has been a rapid increase in the prices of fish which are now higher than ever. Undoubtedly the general increase in commodity prices has had some effect.

8. We have been unable to discover from the examination of official records, extending from 1891 to 1914, any evidence whatever that the banks frequented by the American otter trawlers are being depleted of their fishes. Since 1905 when the first steam trawler began operations off the New England coast there have been fluctuations in the total yield of the bank fisheries, but they have been no more violent nor significant than in the period before 1905 when lines alone were used. In fact, some of the heaviest yields recorded in the line fishery have been made in years since the otter trawl was introduced, and, while the catch of line fishemen in 1914 on Georges Bank, South Channel, and Nantucket Shoals, where the otter trawlers operate, was less than half of that in the extraordinary year 1905, this was accompanied by a proportionate reduction in the intensity of the fishery as measured by the number of trips to these grounds. The average catches per trip of haddock and of cod, haddock, and hake combined have been considerably higher since 1910 than for any similar period of which we have record. The average catch of cod per trip to these banks has decreased since 1910, but it is higher than for any similar period prior to the introduction of otter trawling. As the liners catch, proportionately, more cod and the trawlers more haddock on these banks, and as quantitatively the liners catch

more of each, the statistical facts of the fishery certainly do not indicate that it has yet shown signs of depletion from the use of the otter trawl.

9. We recognize that the conclusions arrived at in the preceding section are necessarily inconclusive for the reason that the otter-trawl fishery in American waters is too recently established and relatively too small to have had a very material effect on the fish supply of the banks frequented. We have therefore examined the accessible data relating to the fishery in England and Scotland, particularly that conducted in the North Sea, where it is most intensive and has been longest established. We have used the data without reference to the opinions others have expressed and have endeavored to arrive at independent conclusions without prejudice from previous investigations of the subject. While the statistical information, particularly that contained in the English reports, is more useful for the purpose than is that pertaining to our own fishery, it is in recent years only that it is given in sufficient detail. Proof respecting the depletion of the fisheries, on the contrary, can not be deduced. The most possible has been the establishment of more or less strong presumptions one way or the other.

10. The cod, haddock, and plaice are the most important and abundant of the demersal fishes of the North Sea, and the three combined comprise about 75 per cent of the catch. English vessels take between 50 and 60 per cent of the total of these species landed from the North Sea, and the English trawlers alone take from 45 to 50 per cent. These three fishes are, therefore, the only ones which it is important to consider.

The statistical data of the English fisheries indicate by a decrease in the total catch, in the average catch per unit of effort, and in the proportion of large fish to the total that probably the plaice fishery is being depleted. The first two criteria also point to a decrease in the haddock, and it is believed that the third test fails to do so only because a lowering in the standard of sizes makes the statistics in this particular misleading. The cod does not show indications of overfishing, probably because its different habits make it less vulnerable to the effects of the predominant fishery, steam trawling.

The statistics of Scotland are less satisfactory for our purpose than are those of England, and it is not possible to obtain sufficient separate data for the North Sea. We have therefore considered the fuller information obtainable in respect to the east coast, the fishery of which is prosecuted mainly in the North Sea. The same three species are discussed, the catch of these by Scotch vessels in the North Sea proper constituting about 25 per cent of the total yield of the three in that sea. The plaice show signs of depletion in the heavy decrease of the total yield and of the average catch per vessel and in the proportion of large fish to the smaller sizes. While the haddock has increased in the total catch, the average catch per vessel has fluctuated to an extent which makes any deductions from the data uncertain; and there is a small decrease in the relative proportion of large fish compared with the total. The cod has increased in total catch and in the average catch per vessel, but relatively fewer larger fish were taken in later years.

Considering the English and Scotch fisheries in the North Sea together, there is a strong presumption of overfishing in the case of the plaice, considerable evidence of the same thing in respect to the haddock, and practically none concerning the cod. As the steam trawler is overwhelmingly predominant in the fisheries for these species, it must be held responsible for such overfishing as may have occurred.

11. Three regions other than the North Sea support more or less important English trawl fisheries yielding essentially the same species which have been discussed. They are Iceland, the White Sea, and the Faroe Islands. Separate data concerning them are available for years subsequent to 1905, and while the period covered is too short to admit of deductions of much value, it has been employed for purposes of comparison with the North Sea.

In Iceland the total catch of both haddock and plaice and the average catch of each, especially the latter, showed heavy decreases, while the cod increased. In all species, but particularly the plaice, there was a decrease in the proportion of large sizes to the total.

In the White Sea the total catch of all species increased from 1906 to 1912, but this was in part due to an increase in fishery activity. As measured by the quantity caught per trip there was an enormous increase in cod, a heavy increase in haddock, and a heavy decrease in plaice. The proportion of large fish was approximately maintained in the cod and plaice but was much smaller in later years in the case of the haddock, thus indicating that the increase in the catch of that species was due to the saving of smaller fishes previously discarded or unsought.

In the Faroes there was a slight increase in the average catch of cod per trip, owing mainly to an increase in the smaller sizes, and a decrease in the haddock, accompanied by a similar increase in the take of smaller fish. The catch of plaice was negligible in all years.

The data from these regions are therefore in general confirmatory of those relating to the North Sea, namely, that there is a presumptive decrease in the plaice, a probable smaller decrease in the haddock, and little or no change in the numbers of cod.

12. The North Sea embraces an area of about 152,000 square miles, which is not all equally productive and part of which is resorted to not at all or very little by English and Scotch trawlers. Georges Bank, South Channel, and Nantucket Shoals cover about 9,800 square miles, a considerable but indeterminate part of which is not resorted to by fishermen and presumably not by fishes in large numbers.

In 1913 English and Scotch (Aberdeen) otter trawlers only made 50,590 fishery trips to the North Sea. Assuming the entire area of the sea to have been fished, there was one trip to each 3 square miles. In the same year 326 trips to Georges Bank, South Channel, and Nantucket Shoals were made by American otter trawlers, which therefore had 30 square miles of bottom to each trip.

This unsatisfactory comparison is the best that we can give of the relative intensity of the otter-trawl fishery in the North Sea and on the banks frequented by the American trawlers. In the estimate respecting the North Sea some unproductive bottom is included and the trawlers of other nationality than the British are omitted, and the estimate of 3 square miles is too high. In the case of the American banks a considerable unproductive area is also included, and while all trawlers are taken into account the estimate of 30 square miles is also too high, but in neither case can we estimate the error. The most specific information concerns the Dogger Bank, having an area of 6,216 square miles, to which English trawlers made 2,196 trips in 1913, or approximately a trip to each 3 square miles.

RECOMMENDATIONS.

While the facts before us show no proof or presumption of any depletion of the fisheries on the banks frequented by American otter trawlers, it is possible that the seeds of damage already have been sown and that their fruits may appear in the future or that the development of a wholly unregulated fishery eventually may result in injury where none now exists. The matter presented for our consideration is the safeguarding of the food supply not only of the existing but of coming generations, and we are therefore less concerned with present conditions than with those which may develop, less with the immediate interests of the parties to the controversy respecting otter trawling than with the ultimate interests of the entire country in the perpetuation of some sort of productive fishery for all time.

We have in the history of our own bank fisheries sufficient information to warrant the belief that there is but little danger of their depletion by line fishing as at present conducted, but there is no such accumulation of data respecting the recently introduced otter trawl; and for an indication of what may be expected from it we must have recourse to the history of the fishery in other places. Otter trawling has been practiced longest and has attained its greatest development in the North Sea, where there appears to be ample evidence that it is being carried on to excess and that the fisheries for certain fishes have suffered in consequence. The problem before us, therefore, is to suggest measures for the prevention of the development of similar conditions in the American fisheries.

The injurious effects of the otter-trawl fishery in the North Sea are believed to be in part due to the destruction of large numbers of small fish, and it has been proposed by certain European authorities to reduce its destructiveness by increasing the size of the meshes of the net to dimensions which will permit the escape of fishes too small to market. We do not regard this as an effective or feasible proposal for the reasons (1) that the meshes tend to close as the drag on the net increases with its burden, (2) that the accumulation of fishes in the cod end closes the avenues of escape there, and (3) that the fishes in any event would not attempt to pass through in large numbers until the net is being hauled in, when the possibility of escape would be reduced to a minimum. An increase in the size of the mesh in the cod end of the net would probably result in an increase in the number of fish gilled, thus not only inducing little mitigation of the destruction of young fishes but entailing additional labor in fishing the apparatus.

There remain three other methods of regulation: The absolute prohibition of the use of the otter trawl or similar apparatus; the restriction of the number of nets or vessels which may be employed; and the restriction of the area on which the apparatus may be used.

The first and most drastic measure would of course be most effective, but in view of the fact that it appears to be the excessive use of the otter trawl which has caused injury to the North Sea we do not regard it as justifiable to prohibit its use on the American banks where it is not yet shown to be injurious. In other words, our present information indicates that it is not fishing with the otter trawl but overfishing which is to be guarded against. The fact that it is undoubtedly more destructive than line fishing is not sufficient for its condemnation, for the same objection can be raised with more or less validity to almost any other net fishery, and we do not know to what extent the destruction of young fishes in the open seas in reality injures the fisheries.

The regulation or restriction of the number of vessels or trawls permissible in the fishery we regard as objectionable for the reason that it would establish an actual or virtual monopoly. The regulation could be made effective only by the issuance of a limited number of licenses or permits, and this would involve either some selection or discrimination among the applicants by the issuing authority or an undiscriminating issuance of permits to the earlier applicants and their refusal to those making application after the predetermined number had been granted.

The restriction of the use of the otter trawl to certain definite banks and grounds appears the most reasonable, just, and feasible method of regulation which has presented itself to us.

It would have the effect of automatically placing some limitation on the number of vessels engaged in the fishery, for the reason that caution would be imposed on prospective investors by virtue of their knowledge that no other fishing grounds were open to exploitation if those allotted to them should be exhausted.

It would cause the trawlers, for reasons of self-interest, to exercise care to reduce as far as possible such abuses or economic defects as may be inherent in the method and to eliminate those which are not essential to it. The results of offenses against good fishery practices would be imposed directly on the prime offenders and would be mitigated to those using other methods by their freedom of resort to other areas where the evils would be manifested little or not at all.

Any injury to the fishery which might result from the development of otter trawling under such restriction would be localized. It would manifest itself chiefly on the banks to which the fishery might be restricted and, especially in respect to the haddock, the fish likely to be most severely affected, would extend but little or not at all to the banks from which the otter trawl might be excluded. Therefore neither the whole, nor even the major part of our bank fisheries, could be depleted by any conceivable development of otter trawling under such restraint.

Being thus localized, inherent evils would more certainly manifest themselves, the effects could be more closely observed and more quickly and surely detected, the fishery could be kept under closer and more accurate observation, and it would be possible by comparison with the conditions on the proscribed banks to discriminate in some measure between accidental fluctuations in the abundance of the fishes and those which might be due to overfishing.

We therefore recommend that the taking of fishes, excepting shellfishes, by means of the otter trawl or beam trawl, or any adaptation or modification of either, or by any other apparatus drawn over the bottom by a vessel in motion, be prohibited on all bottoms in the Atlantic Ocean, outside of territorial jurisdiction, north of the fortieth degree of north latitude, excepting Georges Bank, South Channel, and Nantucket Shoals east of the meridian of Sankaty Head on the island of Nantucket.

This will retain to the otter trawlers sufficient ground on which to prosecute their calling, it will not exclude the liners therefrom, and it will reserve to the latter exclusively the banks to which they make over two-thirds of their trips. It gives a large measure of absolute protection to the important line fisheries of New England, and at the same time will permit the development of an otter-trawl fishery for flounders and other bottom fishes from New Jersey southward on bottoms where they are not, and probably can not be, taken in large quantities by any other means. The flounder fishery of Massachusetts being conducted in territorial waters will not be interfered with. The regulation can be readily enforced, because the open areas are well known, well defined, and can be kept under surveillance. Moreover, every line fisherman in the area affected will be a self-constituted fish warden, prompted by every motive of self-interest to bring infractions of the regulation to the attention of the proper authorities.

It must be understood that this recommendation is based on what we believe to be the conditions at this time. Next year or 10 or 20 years hence they may be different, and it will be necessary to closely observe the developments of the future to the end that a situation shall not arise such as has arisen in the North Sea, which will be recognized as requiring correction, but which will present such far-reaching and important economic aspects as to make rectification difficult or impossible.

In conclusion, we emphatically state it to be our opinion that this regulation will prove futile and an unnecessary imposition on American fishermen unless Canada, particularly, and, possibly, Newfoundland and France will take such action as will prevent or restrict the use of the trawl on the banks in the western North Atlantic.

SURVEY OF THE FISHING GROUNDS ON THE COASTS OF WASHINGTON AND OREGON IN 1914

By Waldo L. Schmitt, E. C. Johnston, E. P. Rankin
and Edward Driscoll

Appendix VII to the Report of the U. S. Commissioner
of Fisheries for 1914

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By WALDO L. SCHMITT, E. C. JOHNSTON, E. P. RANKIN, and EDWARD DRISCOLL.

INTRODUCTION.

In the spring of 1914 the United States Bureau of Fisheries steamer *Albatross* was detailed to make an investigation of the fishing banks reported off the Oregon coast for the purpose of developing their location and extent and supplying definite information as to the character of the fishing grounds, especially those for halibut, the abundance of fish thereon, and the season at which they appear. That the investigation should be as conclusive as possible, it was at first restricted to that section of the coast lying between the Columbia River and Heceta Bank, but later was extended northward to a point off Grays Harbor and southward to include a section of the coast off Coos Bay. This is practically the same region covered by the *Albatross* in her survey of the offshore fishing grounds in 1888–89, and by various commercial fishing ventures both before and after that time, the results of which are narrated hereafter.

The present investigation included a preliminary reconnoissance by Mr. E. C. Johnston, of the *Albatross*, in July, 1913; three fishing trips by the steamer, April 27 to May 16, May 25 to June 1, and August 27 to September 10, 1914, respectively; a visit to the various fishing ports in the latter part of June, by Mr. Edward Driscoll, an expert commercial fisherman, who had charge of the fishing trials during the survey; and a series of fishing trials conducted from a chartered launch out of Newport, Oreg., from July 11 to August 17, 1914, during a period in which the *Albatross* was engaged in other duty.

In order to form a correct estimate of the commercial value of the fishing banks explored, it has been considered necessary to epitomize what was known of them before this investigation was undertaken; but the essential part of the report is embraced in the section, "Results of the investigation." This includes various charts and tables, in which are embodied details of the depths and character of the bottom; the results of sets for fish; the results of trials for scallop beds; and the actual commercial yield of the fishing banks after their value became known as a result of this investigation.

The charts are intended particularly to supply, at a glance, the information desired by fishermen, the depths, and the general character of the bottom. The principal banks are also indicated as such, the position of each set is shown by Roman numerals, and certain fishing trials by two commercial fishing schooners prior to this investigation are plotted, approximately.

Although his name does not appear as an author, no small part of the credit for the results of the survey is due the commanding officer of the *Albatross*, Lieut. L. B. Porterfield, United States Navy. The authors also express their thanks for the information so generously and freely furnished by Capt. Quinn, of the *Idaho;* Capt. Johansen, of the *Chicago;* Capt. Johnson, of the *Daisy;* Capt. Edwards, of the *Helgoland;* and Capt. Churchill, of the New England Fish Co.; and for the many courtesies extended by Mr. Edward Cuningham, of the Pacific Net & Twine Co., of Seattle.

RÉSUMÉ OF THE HISTORY OF THE BANKS.

About the beginning of the year 1885 sea fisheries were commenced off the coast of Washington by the Portland Deep Sea Fish Co. of Portland, Oreg., with a small schooner, the *Carrie B. Lake*, which operated a 40-foot beam trawl between Cape Disappointment and Shoalwater Bay. The catch consisted principally of soles, flounders, and red rock cod, but the venture was brought to an untimely close when the captain, John Exon, an expert beam trawler out of Grimsby, the mate, and cook were lost overboard January 3, 1886. Later the schooner *Dolphin* was built and made 40 trips between April and October, 1887, but she proved a failure, because, it is stated, she could not promptly market her catch, which consisted of soles, flounders, hake, rock cod, and a very few cod and halibut. The "cod" mentioned were probably not *Gadus macrocephalus*, the true cod, but the cultus or ling cod (*Ophiodon elongatus*).

During the fall of 1888 and in the summer and fall of 1889 the *Albatross*, as mentioned before, made quite an extensive survey of the region dealt with in the present report, although but few fishing spots and small banks were developed.[a]

In summation of the investigation, Mr. Rathbun, in the Report of the Commissioner of Fisheries for 1889–1891, page 105, says:

> Only occasional specimens of halibut were taken off Flattery Rocks and Tillamook Rock and on Heceta Bank. Several species of rock-cod were generally distributed along the coast, as well as on the banks, and flounders were found everywhere, being especially abundant in depths of 50 to 100 fathoms. The flat surface of the plateau is particularly rich in the latter group of fishes, * * * Cultus cod occur on all the banks and on Orford Reef, while black cod inhabit the deeper waters, half-grown individuals also being found in moderate depths, together with the ling or Pacific whiting. Large red prawns of excellent quality are likewise very abundant and widely distributed, having been captured frequently in considerable numbers in the beam trawl.

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[a] Summary of the fishing investigations conducted in the North Pacific Ocean, by Richard Rathbun, Bulletin U. S. Fish Commission, vol. VIII, 1888.

In the latter part of 1888 the Yaquina Deep Sea Fishing Co. was incorporated and purchased the auxiliary steam schooner *George H. Chance*, of 71 tons net register, and in 1889 was reported to be making preparations to actively engage in sea fisheries off the coast, but inexperience led to the abandonment of the enterprise.

With reference to a trip of this vessel to the southern part of Heceta Bank, it is stated that on the evening of August 7, 1889, she took several small halibut, and that on a trawl line set overnight the heads of 11 halibut were found the next morning, the bodies apparently having been destroyed by sharks and dogfish.

For a number of years there are no other reports of fishing ventures, but the statistics of the Bureau of Fisheries record 25,000 pounds of halibut taken with lines in Coos County, Oreg., in 1904.

From that time until about 1911 apparently no further attempts to institute fisheries off the Oregon coast were made, but about this year, in September, Capt. A. Edwards, with the steamer *Wieding Bros.* (later known as the *Wieding*), prospected as far south as Heceta Bank. He found practically no good bottom until he made a set on the western edge of the bank and secured 25,000 pounds of fish, but rough weather and the lack of a good near-by harbor caused the abandonment of the trip.

In the 1912 file of the Pacific Fisherman various sporadic and desultory attempts to prosecute halibut fisheries in the region under discussion are mentioned, but none met with success.

On August 31, 1912, the *Ollie S.*, Capt. Carner, a local gasoline passenger boat about 68 feet long, under the guidance of R. E. Voeth, caught several hundred pounds of halibut 12 to 14 miles southwest of the whistling buoy off the Yaquina Bar. This catch and the continued interest of Capt. Voeth, who had prospected for halibut at various times, called attention to the possibility of developing a fishery and finally resulted in the present investigation.

The season's catch from August 31 until about the middle of September, was reported as 20,000 pounds for the *Ollie S.*, and 24,000 pounds for another vessel operating out of the same port.

In May, 1913, the *Idaho*, Capt. Quinn, a 7-dory boat out of Seattle, undertook a prospecting trip beginning under Cape Lookout and ending on Heceta Bank. In all, seven sets were made, the total yield of fish being less than 6,000 pounds. A great many dogfish were taken at every set, and a few black cod in the sets on the shoulder of Heceta Bank. The locations of the sets are plotted on the accompanying charts as rectangles from data furnished by Capt. Quinn.

Returning in March, 1914, from a northern trip, the steamer *Chicago*, Capt. Johansen, 12 dories, of Seattle, also made a short prospecting trip on the reported Oregon fishing banks, hoping to make a quick trip to supply the Good Friday market. About eight trials were made, beginning in deep water off the mouth of the Columbia, running down over the continental shelf, and ending in deep water off Newport, Oreg. The total return from these eight sets, four days' fishing, was about 5,000 pounds, and to make the trip the vessel resorted to the well-known Flattery Banks, where 68,000 pounds of fish were picked up. The approximate location of the sets have been indicated by circles on the accompanying chart.

The reports of the masters of these two vessels on the prospect of developing a lucrative halibut fishery in this region were very unfavorable, and they were confirmed by the results of the operations of the schooner *Decorah*, which in May, 1914, caught but 6.000 pounds of small halibut in 10 days of fishing.

Partly corroborative evidence was furnished also by Capt. E. Clyde Chase, formerly of Marshfield, Oreg., who stated:

> While I was engaged in the salmon fisheries at Marshfield I did considerable experimenting on the halibut grounds off Coos Bay. During the close season in the summer and winter I filled in the time with halibut fishing, and can say that we made some good catches during the months of August and September. The fish did not seem to run in schools. They were mostly caught in scattered spots, and we hardly ever would fish the same ground the second day in succession and achieve good results. We did most of our fishing on a fine gray sand bottom, and we found no ground I would consider good halibut banks.
>
> What halibut we caught were small, not averaging over 15 pounds. I fished most of the ground from the Heceta Banks to Cape Blanco. We found the ground practically the same. During our summer fishing we would catch a few halibut almost anywhere along these sets, but during the months of December and January there seemed to be no halibut at all on the same ground we fished in the summer, but we got dogfish and skates on nearly every hook we set. I believe the halibut come inshore during the summer onto these grounds and can be caught more or less on any of the grounds during that time. But during the winter they go off again and you are unable to find them. I don't consider any ground that I found good halibut banks that would hold the fish.

THE "ALBATROSS" INVESTIGATION IN 1914.

Preliminary to the investigation proper as conducted by the *Albatross*, the fishery expert of the vessel was detailed to make a reconnoissance covering the Oregon coast towns, from which reports of catches of halibut had come, namely, Newport and Bay City. His trip was made for the purpose of obtaining first-hand information regarding the fishing season, weather conditions, and harbor facilities, upon which definite instructions regarding the survey could be based.

At Newport, Oreg., it was ascertained that halibut fishing had been engaged in by the owners and masters of various small freight and pleasure craft belonging to Newport and Yaquina, practically all of it by means of hand lines. During the inquiry in Newport, the *Sea Dog*, a 20-foot boat using three hand lines, caught about 500 pounds of halibut in a 10-hour day; and the *Wanderer*, a 60-footer, reported making a catch of about 1,000 pounds with the same number of hand lines from the afternoon of July 16 to the afternoon of the day following. The best catch of the season was said to have been 1,800 pounds taken by Capt. R. E. Voeth, of the *Wanderer*, with two regulation halibut trawls.

The fishing season out of Newport was found to be usually from April to early September, being limited by the rough weather prevailing during the late fall and winter. The local fishermen alleged that halibut can be taken the year round; as they are able to make but very few trips from September to March they were not sure as to the abundance of the fish in winter.

It was learned that there was practically no halibut fishing at Bay City. Only once in a while, in smooth weather, a boat goes out for halibut as a pleasure trip. There were rumors of several notable halibut catches, but little of which could be traced to an authentic source.

The primary interest in both places seems to be to ascertain if there be a sufficient supply of fish to warrent the building of cold-storage plants with which to make a bid for the Portland and other markets.

In the main, the inquiry developed that, at least off Newport, a scattered run of fish during the summer months could be obtained; that the weather conditions, other than from April to September, were too uncertain and severe to warrant an investigation during any other time; and that harbor facilities for a vessel the size of the *Albatross* were not available. As a consequence, the survey was deferred until the following spring.

On April 12, the *Albatross* left Sausalito, Cal., for Seattle, Wash. At Seattle, Mr. Edward Driscoll, expert fisherman, and four other practical fishermen were engaged, and after taking aboard the necessary gear and equipment the ship left Seattle April 24 on her first trip over the ground.

On April 29 actual operations were begun on Heceta Bank, selected at the time as the southern limit of the field of investigation, and continued northward, with several interruptions due to stormy weather, until May 8, when a return was made to replenish the coal bunkers.

Most of the soundings and trials were confined to the deeper water, 90 to 100 fathoms, as during the spring halibut are more likely to be found on the offshore edges of the banks. On the completion of this line it was found that the plan of operations would permit working over a portion of the inshore ground, and a series of trials of the bottom was made along the 50-fathom curve, beginning off Yaquina Head to a point off Tillamook and thence in a northwesterly direction to deep water off the Columbia. Three sets of the trawls were made on this line of soundings.

This trip failed to demonstrate the occurrence of good bottom, bottom that would hold fish, and also an apparent absence of fish in paying quantities in the spring of the year. Three possible spots were located, sets I, II, and IV (chart I, table I), of which only the first seemed to be at all favorable with respect to the bottom. Unfortunately, because of the rough weather prevailing at the time, a more thorough trial could not be given.

The results led to the expectation that halibut, if they were to be found off the Oregon coast, would occur only in the nature of a seasonal (summer) run when the fish come inshore in search of food, irrespective of the character of the bottom. Such appearances of fish on poor and unfavorable bottom are usually incidental and do not continue throughout the year.

One indication of the occurrence of scallops, also reported from these banks, was brought up at set VI in the shape of several dead valves to which sea anemones were attached.

On leaving Seattle May 25, on the second trip, it was the intention to give the spots developed on the previous trip more conclusive tests and to pay particular attention to the section just off Newport, from which most of the reported fish were said to have been taken. Through an accident this trip was brought to an abrupt end on May 29, after but two days' fishing, necessitating an immediate return to Seattle for repairs.

From June 12 to August 27 the *Albatross* was engaged in Alaska, but the halibut investigation was continued by other means. From June 15 to 29 Mr. Driscoll made a tour of the Washington and Oregon fishing ports in the region under investigation for the purpose of obtaining information regarding catches which might otherwise not be reported and which might be indicative of a summer run of fish. He visited Newport, Portland, Tillamook, and Astoria, Oreg.; and Aberdeen, Wash.

At Newport Capt. Reeder, of the *Orabell*, on June 17, caught 25 halibut, averaging about 20 pounds, although some weighed but 6 pounds, "a very uneven run, which looks as though there were not many where these were caught." On June 10 the same craft took 4 halibut, averaging about 15 pounds, 2 redfish, and 2 ling cod, about 7 miles off the bar, and the *Pilgrim*, Capt. Chambers, brought in 1 halibut, 2 red cod, and 2 ling cod from about 8 miles offshore. Capt. Chambers stated that "the fish are not plentiful now, but later on they bunch up, and many can be caught when they strike in in August. There are no large banks such as have been reported, but there is one fishing spot 15 miles southwest by west from Newport bar and another 16 miles west."

In Portland it was learned that the *Decorah* had brought in 2,200 pounds of good fish, averaging about 15 pounds, from Heceta Bank.

At Tillamook no fish were being caught. No information regarding halibut was to be obtained in Astoria, the fishermen there being engaged wholly in salmon fishing, and at Aberdeen a schooner, the *Zilla May*, was being fitted with an otter trawl, her owner having a market for miscellaneous fish such as are caught with that implement.

From the information secured by Mr. Driscoll, in addition to that already at hand, it was concluded that a paying run of fish had not yet occurred, and that if it were to be found fishing trials should be continued without interruption. A part of the *Albatross* staff and Mr. Driscoll, with the practical fishermen previously mentioned, were therefore transferred to Newport, where fishing trials were carried on from July 13 to August 17, 1914, from a gasoline launch chartered for the purpose.

Contrary to all earlier indications, a nice run of halibut was found within an area of about 250 square miles—between about 8 miles northwest by north (magnetic) of Yaquina Head Light and approximately 15 miles southwest (magnetic) from the whistling buoy on the Newport bar. Within this area 14 sets were made, varying from one to three hours in duration and using from one to three skates of gear, with salt herring, surf perch, frozen herring, and fresh salmon bait. From 200 to 500 pounds of halibut, dressed weight, were taken to the skate, and from this it was estimated that a dory running a line of six to eight skates and using fresh salmon bait could take 1,500 to 2,000 pounds of fish with a five to six hour soak anywhere within the area indicated, an estimate verified by the results of commercial fishery operations, as shown in table IV of this report.

Several trials for scallops made in connection with some of the sets have been dealt with in detail under the heading "Scallops."

During this period of the investigation the schooner *Daisy* (three dories), induced by the representations of the owners of the local cold-storage plant, made several successful trips, and the schooner *Decorah* also operated off Newport, but with indifferent success.

As yet the Seattle fleet had not been made acquainted with the results of the investigation; but one of the fishermen in the Bureau's service resigned to take command of the *Decorah*, and with his return to Seattle, to secure a competent and experienced crew, full information as to the various prospects was given to the public. Thereupon several schooners made trips netting returns as good as those made on the various well-known Alaska banks during the same period, and a small but profitable fishery was definitely established on Newport Bank.

The Newport cold-storage plant on two occasions took over a portion of the *Daisy's* catch, 19,000 pounds on July 11 and 17,000 pounds on July 30; but owing to the limited size of the sharp freezer it could handle only the fresh, iced fish for immediate shipment to near-by towns. Neither the plant nor the market seemed able to take care of even such limited quantities of fish except occasionally, and so far as known no landings other than by small local craft were subsequently made at Newport.

A few halibut, in no case exceeding 29, were caught by local fishermen in July, but in August, after the productiveness of Newport Bank had been partially demonstrated, three fares of 1,400, 1,500, and 1,900 pounds, respectively, were taken.

During the time spent by the party at Newport it was noted that the local fishermen did not avail themselves of all opportunities presented, nor was any great energy displayed in prosecuting the little fishing that was carried on. This was in part due to the lack of a sufficient local demand; to high express rates to outside points, i. e., Portland; and undoubtedly to uncertain and unfavorable bar, weather, and fog conditions which necessarily would result in a very irregular and fluctuating supply.

There is also lack of an adequate supply of bait. The surf perch which were used on several occasions proved to be good, but, though apparently occurring in great abundance, they doubtless would become depleted in a short time if extensively used, even if seining for them could be carried on without detriment to the local crab fishery. Spring and fall runs of herring take place in Yaquina Bay, and though no definite data were procurable concerning their abundance, the local fishermen, who salt them for their own use, hardly had enough to last through the fishing season. There is a limited run of salmon of such late occurrence that it could not be utilized as a source of bait and the quantity is very questionable as most of the fish displayed for sale in the local markets had been shipped from Alsea Bay.

The *Albatross* made its final run over the ground, leaving Seattle August 27, returning September 8. On this occasion fishing trials were begun as far south as Coos Bay to ascertain if a run of fish such as was developed off Newport might occur in that vicinity. One set as successful as many off Newport, was made on a likely piece of bottom upon which further prospecting should show good fishing. More intensive investigations were carried on during this trip than was possible on the previous ones. Former sets were checked up and gaps in the various lines of soundings filled in wherever possible; and results of a more positive nature were obtainable regarding the abundance of fish, inasmuch as the best of bait, fresh salmon, was employed, and as a long soak was given.

Trials were also made for scallops both off Yaquina, where launch work had been attempted during the summer, and off Cascade Head, where evidences of the presence of scallops had been found on the occasion of the first *Albatross* trip. Here a bed of scallops possibly in sufficient abundance to warrant private investigation was touched upon, while off Newport, though no scallops were secured, a great abundance of the smaller flatfishes was demonstrated.

The northern limit of the field of investigation was also extended so as to take in a section of the coastal banks off Grays Harbor, where one set and a number of soundings were made. After touching at Seattle and coaling at Union Bay, British Columbia, the *Albatross* proceeded to Sausalito, Cal., where she arrived September 15, 1914.

RESULTS OF THE INVESTIGATION.

WEATHER CONDITIONS.

While en route to the field of investigation the *Albatross* was compelled to heave to for 17 hours, and several times during the survey boisterous seas necessitated the cessation of fishing operations.

That fishing trials were made at Newport on so few days was not due solely to the state of the weather, but also to the condition on the bar off the mouth of Yaquina Bay. Sets were made on but 14 of 36 possible days of the time spent there. On 16 of the remaining 22 days the fog was very thick or threatening, and on the other 6 days either tidal conditions or, more frequently, breakers rendered the bar impassable. During practically one-third of the time spent at Newport the state of the bar, aside from other conditions, prevented fishing.

The United States Coast Pilot, Pacific Coast (second edition, 1909) says:

> The channel over the bar (at Newport, Oreg.) has a depth of 11 to 14 feet, but is narrow and winding and should not be attempted by strangers without a pilot. A reef extends for nearly 1½ miles northward of the entrance about ½ mile offshore; and southward of the entrance at a distance of about 1 mile, is a patch of sunken rocks, usually showing a breaker. In the approach to the entrance, which is between these rocks and the reef, the bottom is irregular, with several depths of 4 fathoms and less. Inside the entrance the channel is subject to frequent change. * * * The entrance in winter is exceptionally bad on account of the heavy swell and the place is not recommended.

The channel over Newport bar, as far as our experience with it indicated, has a depth of about 9 feet at low water, but it is claimed locally that a channel carrying 14 feet can be followed. There is a gap in the reef through which small craft can approach the bar channel from the west, avoiding taking the seas broadside on in northwesterly weather. This gap usually can be readily picked up by one familiar with its position, provided the breakers are not so high as to completely obscure it.

There are two partially completed breakwaters off the harbor entrance, but they are almost worse than useless, ending well within the most dangerous ground. Until they are extended into sufficiently deep water, possibly across the reef, Yaquina Bay will be handicapped as a fishing port.

Somewhat similar conditions obtain off Tillamook, concerning which the Coast Pilot says:

> Sixteen feet have been carried over the bar at high tide with a smooth sea. * * * The position of the channel can not be depended upon and is liable to change in heavy weather. * * * North of San Francisco, Humbolt and Coos Bays, Columbia River, Willapa Bay, and Grays Harbor afford good shelter, but must be made before the sea rises, as afterwards the bars are impassable.

The *Albatross* did not begin work until well into spring, owing to the severe weather conditions prevailing during the winter. Throughout the spring and early summer fresh, brisk gales were of frequent occurrence, usually lasting for several days at a time, and, if from the southeast, accompanied by fog. During the late summer and early fall much less rough weather was experienced, but the fogs, on the other hand, were denser and more troublesome, and with the end of September winter conditions were ushered in.

On the whole, both small boat and vessel fishing, irrespective of the run of fish, is restricted by weather conditions to the five months, late April to early September, and even then a great many days during the summer are much too rough or foggy to permit the smaller craft to operate with any degree of safety.

For the convenience of those using this report, the following very excellent recapitulation of weather, wind, and fog conditions is quoted from the United States Coast Pilot, Pacific Coast (second edition, 1909, pp. 10–11):

> *Weather.*—There are two seasons—the summer or dry season, which begins about May and continues until October, and the winter or rainy season, covering the remainder of the year. These seasons vary in length in different parts of the coast as well as in different years.
>
> Northward of San Francisco the rainy season increases in length and amount of rainfall, and as Juan de Fuca Strait is approached showers of short duration and generally local may be looked for at any time. Snow falls at rare occasions in San Francisco and vicinity, but is frequent and at times heavy in the vicinity of Juan de Fuca Strait. From San Francisco northward the winter gales increase in severity, frequency and duration, while in summer the northerly and northwesterly winds at times reach almost hurricane strength.
>
> *Winds.*—The prevailing winds in summer are from northwest and west, on the northern part of the coast. * * * The northwest winds in summer frequently reach a velocity of 70 miles an hour and extend as far south as Point Conception. * * * As a rule, the northwest wind begins about sunrise and reaches its maximum velocity about 3 or 4 p. m., moderating toward sunset and dropping to light airs or calms by daylight. The severe northwesterly gales generally last two or three days and continue throughout the night with little or no diminution.
>
> In winter the heaviest weather is from the southeast and southwest, with an occasional northerly gale of short duration. These gales, with the heavy southwest swell prevailing during the winter months, cause a confused, irregular sea that taxes the weatherly qualities of a vessel to the utmost. They spring up gradually from southward and increase in strength, with a rapidly falling barometer. When the barometer

becomes stationary the wind shifts to southwest and blows heavily, with clearing weather and frequent rain squalls. The barometer rises when the wind hauls to southwest, from which point it generally blows from 12 to 20 hours.

When the southwest gale of winter is not preceded by southerly weather the barometer seldom falls, but either remains stationary, when the gale may be expected to continue longer, or rises slowly, when it will gradually subside and fine weather follow.

Fog.—On the outside coast fogs are liable to occur at any time, but are more frequent in July, August, and September. * * * In the northern parts of the coast they are more frequent and at times very dense, and have been known to extend several hundred miles seaward. They are generally brought in toward sundown, from seaward, by light westerly winds, and ordinarily continue until noon of the following day and sometimes later.

CHARACTER AND TOPOGRAPHY OF THE BOTTOM.

On the accompanying two charts the character and topography of the bottom have been graphically represented by means of contour lines and colors, the significance of the latter being explained in the legend on the chart. The contour lines are based almost wholly on the Coast and Geodetic Survey charts Nos. 5900, 6000, and 6100, which in turn have been compiled largely from the *Albatross* data secured in 1888–89. The curves are spaced at 10-fathom intervals, beginning at 30 and ending with 100 fathoms, omitting the 90-fathom contour, which nearly approximates the 100-fathom line. The fishing sets and scallop trials made during the survey are indicated by means of Roman numerals, the exact location being the center of the space covered by the letters. The location of sets of the *Idaho* are shown approximately by a series of dotted rectangles numbered in order, and those of the *Chicago*, by numbered dotted circles.

For convenience of treatment the bottoms surveyed are discussed under the following heads: (1) Grays Harbor section, (2) Tillamook section, (3) Newport section, (4) Heceta Bank section, (5) Coos Bay section. The intervening stretches are considered with the sections with which they can be most readily treated.

Grays Harbor section.—Off Grays Harbor the continental shelf, which here attains a width of about 25 to 30 miles, is covered from shore outward to between the 40 and 50 fathom curves with fine gray sand, and beyond that line out into deep water is composed almost uniformly of green mud. An outcrop of shale was found on one sounding about 25 miles west of Point Chehalis. In the vicinity of Chehalis Bank, reported by Capt. Tanner, the soundings increased regularly in depth offshore, and showed nothing but green mud from the 46-fathom mark to a depth of 64 fathoms and doubtless beyond that.

To the northward of this reported bank, and between 10 and 15 miles offshore, a patch of gravel bottom was found in 38 to 40 fathoms. It is apparently of considerable extent, and though no halibut were taken on it (set XXXVIII), it is rich in bottom life and may be found to be productive at times.

The Tillamook section.—On this silt area off the Columbia River but little sounding was done for obvious reasons. The mud beginning at the mouth of the river runs out to and apparently follows the 50 or 60 fathom curves throughout the greater part of this section. South of the river and inshore of the mud the bottom was found to be fine gray sand, except at one sounding.

In the mud area there are two outcrops of shale. One is a small ridge about 25 miles off Tillamook Rock, where the least depth was 78 fathoms. One-half mile beyond this sounding green mud was found in 94 fathoms, and 3 miles inshore the same material in 83 fathoms was recorded. The second sounding showing the occurrence of shale was in 98 fathoms, about 18 miles off the entrance of Tillamook Bay. It is believed that a great many of these outcrops are to be found, as the Miocene shales seem to be the principal formation of the continental shelf off the Oregon coast.

On the fine gray sand within the 60-fathom curve, about 9 miles south of Tillamook Rock, a small patch of shale resembling hard mud was discovered, but an attempt to relocate it later proved unsuccessful. Between Cape Falcon and Tillamook Bay coarse gray sand was found on a single sounding, in 32 fathoms. From all indications it is doubtful if halibut will be found here in paying quantities, although it is the most promising bottom found off Tillamook.

Conditions apparently similar to those off Tillamook seem to obtain in the stretch between Cape Lookout and Cape Foulweather. Under Cape Lookout, on an area not tried out by the *Albatross*, both the *Daisy* and the *Idaho* report very good appearing gravel bottom, although none but small fish have been taken there. Below Cape Lookout the continental shelf has a width of but 10 miles, and in this vicinity, just off Cascade Head, there is a patch of fine gravel adjoining one of coarse gray sand in 42 and 30 fathoms, respectively. Though two unproductive sets of the trawl lines (VI and XXXV) were made just offshore from these patches, it was in the vicinity of set VI, off the gravel patch, that the best scallop catch was made.

The bottom throughout the Tillamook section seems to be generally unfavorable for halibut, though it supports a great many of the smaller flatfishes and other, at present, less marketable species.

Newport section.—South of Cape Foulweather, off Yaquina Head, the regular progression of increasingly deeper soundings from the shore outward is no longer found and green mud or fine gray sand bottoms lose their predominence. In this region the mud line is generally found at 90 fathoms or beyond.

Between Yaquina and Alsea Bays and about 12 miles off shore, a ridge was discovered on which 30 fathoms was the minimum sounding made by the *Albatross*, although Capt. Carrol, until recently of the *Decorah*, reports that he made one sounding of 20 fathoms in this vicinity. This ridge is the outer wall of a submarine valley having, so far as sounded, an extreme depth of 47 fathoms, shoaling at its mouth to 42 fathoms and merging with the flat of the continental shelf at the 50-fathom curve. On both sides of the ridge, and principally at the upper end of the submarine valley formed by it, the late summer run of halibut, developed by this survey, was found. The bottom across the head of and through the greater extent of the floor of the valley is of coarse gray sand, carrying a very rich growth of such organisms (sea anemones and pennatulids) as are typically found on good halibut bottom.

Over the ridge and principally on its northwestern and southern slopes is found what has been designated as broken bottom—composed of materials of a mixed character, shale, gravel, sand, and mud—in patches varying in size and composition, but all very rich in bottom-living organisms. On the western slope is a patch of coarse gray sand and another of gravel, apparently of considerable extent, though no great number of soundings were made there. On this patch a good lot of fish were taken (set XXXIV).

Heceta Bank section.—Similar to the ridge off Newport, but larger and in somewhat deeper water, there is a large, roughly triangular plateau called Heceta Bank, between 25 and 30 miles offshore to the southwestward of Heceta Head. It is composed largely of shale too hard for good halibut bottom, while the submarine valley formed by it is too soft, having a bottom of soft green mud. Several patches each of broken bottom and black sand occur both on the flat of the bank and on the offshore slopes. The most promising broken bottom is in the vicinity of set XI, where a lot of fish were taken in the spring of the year (set I). Black sand is considered good black cod bottom and on one patch of it (set X) a fair catch was made.

Between Heceta Bank, Alsea Bay, and Heceta Head is a large area of fine gray sand which below Heceta Head is encroached upon by the green mud of the submarine valley formed by Heceta Bank. Off the mouth of the Siuslaw River is a small isolated patch of gravel surrounded by fine gray sand. The mud line trends in from the 70-fathom line toward the Umpqua River, where it reaches the 30-fathom curve less than 2½ miles offshore. Another gravel patch about 7 miles below the Umpqua lies within this mud area but 6 miles from shore, and south of this the mud recedes until it lies beyond the 70–80-fathom line 10 miles off Coos Bay.

Coos Bay section.—In a line between the Umpqua River and Coos Bay, three sets (XXVII, XXIX, and XXX) were made on fine gray sand, which occurs everywhere in this region inshore of the mud. As developed by the above sets, this sand bottom seems to carry a thin surface film of mud or else the line of demarcation between the two extends much nearer shore than has been shown either by the chart or the soundings.

Southward of Coos Bay, extending well toward the Coquille River, is a comparatively extensive outcrop of shale, rich in bottom organisms, in which the soundings developed two areas of good halibut bottom, fine gravel. The soundings, together with the yield of set XXVIII, seem to indicate that more detailed examination might locate areas of so-called broken bottom, which is more productive of fish than shale alone.

DISCUSSION OF THE SETS.

In table I will be found all pertinent information regarding the various fishing trials made during the survey, with the exception of those made exclusively for scallops, which are shown in table II.

In some cases, instead of making a double-banked set, the dories were spaced about a half mile apart and acted independently, although for all practical purposes they were making but a single set. Double-banked sets primarily were made in rough and threatening weather and later for the purpose of saving time and making several sets a day in addition to the routine of sounding. These are indicated in the column "Addenda," table I.

The skate used was the regular 8-line trawl as rigged and used by commercial fishermen, carrying about 250 hooks spaced 9 feet apart. At Newport, July to August, in addition to the regular gear, a single line rigged with small hooks and light gangings was set for soles, flounders, and other small-mouthed bottom fish. This gear was not very effective and such fish as were taken with it have been included in the regular columns of the table.

The bait throughout the first two trips and in part during the Newport trials was salt herring purchased in Seattle, not in preference to fresh or frozen fish, but because of the lack of facilities on the *Albatross* to care for a sufficient quantity of cold-storage bait. At Newport, clams, surf perch, and salmon were obtained from the local fishermen, but were not always to be had in sufficient quantity, and salt herring were used to make up the deficiency. A small stock of frozen herring was obtained from a supply left by the schooner *Daisy*. On the last trip of the *Albatross*, through the special efforts of the commanding officer, several boxes of iced salmon were carried in the ship's very limited cold-storage space.

The weights of the halibut taken are given under different classifications in table I. To give an idea of the proportion of first-class fish, weighing from 11 to 80 pounds, inclusive, the number of these has been given in one column and their average weight in another.

Set I.—April 29, on Heceta Bank, in 88 to 92 fathoms, broken bottom. The offshore dory, which fished in the deeper water, on gravel bottom, took one 72-pound halibut; the inshore dory took the remainder of the total catch of 296 pounds of fish, which averaged about 31 pounds. Of these, 8 were first-class fish, weighing between 11 and 80 pounds, averaging about 37 pounds each. All were nice looking, blue-meated halibut. Though salt herring bait was used and a one-hour set made, the result would seem to indicate that in this vicinity a good catch of fish might be expected in the spring. The result of the *Idaho's* sets Nos. 5 and 6, in the spring of 1913, do not bear out this assumption, but at times a distance of a half mile will put a schooner off a very good spot. This set was near the probable location of Capt. Edwards's very successful trial in 1911 or 1912. The dogfish were quite troublesome, 21 being taken, together with 34 red rock and 1 ling cod. Rock cod usually frequent a bottom somewhat more rocky than that preferred by halibut.

Set II.—May 2, off Newport, well on the edge of the bank in 96 fathoms; bottom green mud with an admixture of black sand, underlaid by siliceous shale. The mud adhered in stringy masses to the trawl lines, an evidence of soft, unfavorable bottom. One 20-pound halibut, 1 dogfish, 4 skates, 8 red rock, and 3 ling cod were taken.

Set III.—May 5, on Heceta Bank, about 15 miles north of set I, in 61 fathoms; on broken bottom composed of granular shale and fine gravel. One small fragment of rock caught on the trawl. Two skates were set from each dory. Of the 4 halibut taken, 3 were first-class fish, averaging 26 pounds, and the other 10 pounds. The spring run of dogfish was again encountered, 80 being taken.

Set IV.—May 6, about 13 miles off Newport, in 54 to 57 fathoms; fairly good bottom, composed fine black sand, broken shells, and coarse gray sand. A basket star, indicative of "live" bottom, was brought up at this station. Of the 8 halibut caught, 7, averaging 21 pounds, were first-class fish. Thirty-six dogfish and 9 red fish were taken.

Set V.—May 6, off Newport in 62 fathoms, on granular shale and some fine gravel, rather too hard bottom for halibut. Twenty-one rock cod and 4 small halibut of an average weight of 14 pounds were caught.

Set VI.—May 7, off Cascade Head, in 48 fathoms; the sounding indicated fine gray sand, and 4 large sea anemones attached to scallop shells were brought up on the trawl line. No halibut were taken, 1 flounder, 1 ling cod, 2 red rock-cod, and 6 skates constituting the total catch. It was hardly expected that halibut would be found on the fine gray sand indicated by the sounding lead, and the set was made merely to determine what might be expected on bottom of that character. A later set (XXXV) in the same general locality was hardly more productive. Farther inshore the bottom gets better, being composed of fine gravel, but the *Chicago* made a set (5) there on April 2, in 12 fathoms, with but poor success.

To the northward, under and near Cape Lookout, the *Idaho* made two sets (I and VII), both on sand bottom, on May 11 and 14; although Capt. Quinn said that the last set was on the best bottom he had seen on his entire trip, he caught only 500 or 600 pounds of fish, practically all small. The *Daisy*, on gravel bottom under Cape Lookout, about July 30, caught 4,000 pounds of halibut, all too small to market.

Set VII.—May 8, off the Columbia River; picked up granular shale, obviously a very small patch, as in the immediate vicinity of the dories the *Albatross* bottom sampler brought up a core of soft green mud 2½ feet long. The total catch yielded but one 32-pound halibut, 15 dogfish, 1 skate, 1 sole, and 1 octopus.

Of the above seven sets, I and III offer possibilities of good fishing spots. The bottom is very much alive, as found by the *Albatross* on this and her 1888–89 trips, carrying a great variety of bottom organisms. Set IV also has good bottom, of a coarse gray sand, tending toward that later found just off Newport and carrying a good run of fish during the months of July, August, and September. It is very probable, in view of later developments, that had fresh herring or salmon been employed instead of the salt bait used and a longer soak given, a materially larger catch might have been returned in each case. The other sets, with the possible exception of set V, on granular shale and fine gravel, were made on unfavorable bottom.

Dogfish were taken in nearly every set and, as can be seen, are a great pest in the spring. The great number of "dogs" at this season was the one great difficulty encountered by the *Idaho* in her attempt to make successful fishing trials.

Set VIII.—May 27, off Newport, in 31 to 34 fathoms; bottom, fine gray sand. As but 3 halibut, averaging 23 pounds each, were taken, this was considered poor bottom, but after completing the chart of the fishing grounds it was seen that this set was on the edge of the fishing ground proper, and the 6 sea pens, or pennatulids, taken on the trawl line show the presence of bottom life of a character to warrant the inclusion of this area in the bank.

Set IX.—May 28, on Heceta Bank, in 66 to 68 fathoms; bottom, granular shale, part of a large siliceous shale area, which is to be generally considered as poor bottom. Five halibut, including 4 first-class fish, averaging about 25 pounds each, were taken.

Set X.—May 28, on Heceta Bank, in 109 fathoms; bottom, fine black sand and some fine gravel, apparently good halibut ground, but tending in character and depth to be more favorable for black cod, as indicated by the results of the set. Twenty-six black cod weighing 276 pounds, the fish ranging from 7 to 18 pounds and averaging 10.6 pounds each, were caught. Only 1 halibut, weighing 16 pounds, was taken.

Set XI.—May 29, on Heceta Bank, in 100 fathoms, bottom, fine black sand. No halibut were taken and but 5 black cod, ranging from 5 to 16 pounds and averaging 12 pounds each.

Sets XII–XXVI.—Were made out of Newport during July and August, gear being set and hauled from a launch chartered for the purpose.

Sets XII–XVIII and XX–XXIII.—July 13 to August 14, off Newport, in 25 to 47 fathoms, on coarse gray sand. This was rich bottom, numerous pennatulids, sea anemones, and sun stars being brought up on the trawl lines. The bait used consisted of surf perch, fresh salmon, frozen and salt herring. All of these sets were on good fishing ground, from 5 to 45 halibut, weighing from 132 to 1,867 pounds, total weight, being taken on from 1 to 3 skates of gear in from 1 to 3 hours. The fish averaged 20 to 48 pounds each. There are some living scallops scattered over this bottom, but so far as could be ascertained, in about a dozen trials with an oyster dredge, they were widely scattered.

Sets XIX, XXIV, and XXVI.—July 27, August 15, and August 17, respectively, off Newport, in 35 to 40 fathoms, on broken bottom consisting of rocky shale, coarse gray sand, fine gravel, and foraminifera, in patches of various degrees of admixture, and resembling the bottom found on Heceta Bank in sets I and III. One to two skates of gear were used in sets of two hours' duration, with octopus, salt herring, and salmon as bait. The yields were from 559 to 935 pounds of halibut, consisting of 27 to 36 fish, averaging 20 to 32 pounds. First-class fish averaging as high as 40 pounds each for 22 out of a total of 29 were taken. All sets were on good fishing ground. Set XIX is the only one in July where more than 8 dogfish were taken. A total of 13 were taken here.

Set XXV.—August 16, off Newport, in 37 fathoms, on fine gray sand, with 1 skate of gear, fresh salmon bait, set two hours; resulted in a catch of 355 pounds of fish—9 halibut, all first-class and averaging about 39 pounds each. Ordinarily this kind of bottom does not carry fish; but on the fishing ground off Newport the patch of fine sand which extends along the submarine valley floor between the inshore coarse gray sand and the offshore broken bottom apparently is an exception. Twenty-eight dogfish were caught, the only case in August in which the catch exceeded 4.

The following sets, made on the last trip of the *Albatross*, were of two hours duration, double-banked, one skate to each of the two dories, using fresh salmon as bait, excepting set XXXVIII, in which each dory used two skates of gear and operated independently one-half mile apart, bait and duration of set otherwise being the same.

Set XXVII.—August 29, off Coos Bay, in 36 fathoms; bottom, fine gray sand, covered with a layer of slimy mud, which came up in stringy masses on the ground line. This set was evidently very near the mud, and the same kind of bottom was also found on sets XXIX, XXX, and XXXI. Two halibut weighing 12 and 20 pounds, respectively, were taken in addition to 3 skates, 3 soles, and 1 ratfish.

Set XXVIII.—August 30, off Coos Bay, in 65 fathoms; bottom, granular shale. The bottom here differs from the others found at the sets made between Coos Bay and Heceta Head, which were of the character described under set XXVII. In the catch this set is comparable to those on the broken bottom on Heceta Bank and off Newport, 13 halibut, totaling 375 pounds, being taken. Twelve of these were first-class fish and averaged 24 pounds each; the other weighed 85 pounds. This set was just north of a promising patch of gravel bottom, which will doubtless carry many more fish than were taken here. The whole area comprising the shale and gravel bottom in this vicinity should be considered a possible fishing ground, and more extensive soundings might develop even more favorable bottom.

Sets XXIX–XXXI.—Sets XXIX and XXX were made off Coos Bay, August 30 and 31, in 30 and 37 fathoms, respectively; set XXXI was off Heceta Head, August 31, in 42 fathoms. All have the same character of bottom as set XXVII and were as barren of fish. At set XXIX only were any halibut taken, and here but three, weighing 9, 10, and 90 pounds, respectively. Otherwise a few skates and soles constituted practically the entire catches.

Set XXXII.—September 1, on Heceta Bank, in 82 fathoms; on granular shale and fine black sand approaching broken bottom in appearance. This set was in the vicinity of sets I and IX, on the point of Heceta Bank. Seven halibut, totaling 259 pounds, were taken in a two-hour double-banked set of two skates, using fresh salmon bait. Six of these were first-class fish, averaging about 41 pounds. As previously noted, on April 29 (set I) we took 296 pounds of fish on one skate, one-hour set, salt herring bait, 9 fish all told, 8 first-class, averaging 37 pounds each. Though not very plentiful when this trial was made, it is safe to predict that fish in paying quantities will be found on or near this spot during some time of the year, but the area is very small and must be picked up largely on soundings. Twelve dogfish were taken in addition to 30 blue sharks, 18 skates, 1 ratfish, 2 black cod, 3 ling cod, 3 soles, and about 150 red rock-cod. The quantity of red fish was most remarkable. When they were cast overboard from the dories they attracted numerous dogfish and blue sharks.

Set XXXIII.—September 1, on Heceta Bank, in 87 fathoms, off shore from set III; on broken bottom composed of shale of varying degrees of hardness, with patches of fine black sand. The bottom here is apparently rich, as a 16-inch-high basket sponge was brought up on the trawl. Three halibut averaging 55 pounds were taken, and 5 black cod averaging 16 pounds each; the rest of the catch comprised 2 blue sharks, 6 skates, 2 rock-salmon, and only 31 red rockfish; only 7 dogfish were brought up.

Set XXXIV.—September 2, off Newport, more on the flat of the bank than the preceding sets and in the general direction of the Newport fishing ground, at a spot where coarse gray sand, fine gravel, and broken shells were found in 63 fathoms. Nine halibut, averaging slightly over 32 pounds each, were taken, the total weight being about 290 pounds. With a catch such as this, of good fish, the Newport fishing ground prospected over in sets XII to XXVI can with good reason be extended so as to include this spot.

Set XXXV.—September 3, off Cascade Head, in 45 fathoms, on fine gray sand. The bottoms at this and the two succeeding stations were given trials to fill in what otherwise would be a questionable gap, but no halibut fishing of consequence is to be expected on continuous fine gray sand bottom. One 57-pound halibut was taken, together with 10 dogfish, 4 skates, 3 ling cod, and 2 soles.

Set XXXVI.—September 4, off Tillamook, in 43 fathoms, on fine gray sand. Two halibut weighing, respectively, 9 and 16 pounds were taken, in addition to 6 dogfish, 2 blue sharks, 3 skates, 4 young black cod, 1 sole, and 1 arrow-toothed halibut. The latter was the only one of the species taken on the entire cruise, in marked contrast to Tanner's previous trip over the ground, when he thought that this would be the species of halibut most likely to be found in fishing off this coast.

Set XXXVII.—September 4, off Tillamook, in 56 fathoms, on fine gray sand, apparently barren bottom; yielded 2 dogfish, 4 blue sharks, 1 small black cod, and 1 sole.

Had the bottom of the Tillamook section been more varied or more favorable other sets would have been attempted. The results of the early *Albatross* trials, given in the introduction, are in very close agreement with those obtained in sets XXXVI and XXXVII.

Set XXXVIII.—September 5, off Grays Harbor north of Chehalis Bank, reported by Tanner in 1888, in 38 fathoms, on a rich bottom of fine and coarse gravel. Several sea anemones were brought up on the trawl, a favorable indication. No halibut were taken, the total catch being 1 dogfish, 1 skate, 1 blue shark, and 1 red rock-cod. Even with this poor showing, fish are to be expected on bottom of this character at some time during the year, and it might repay schooners on the way to and from the Newport ground to make several prospect sets in this vicinity in passing.

Though in 1888 and 1889, and again during the present survey, no halibut were taken in this vicinity by the *Albatross*, Capt. J. W. Collins, in his "Fisheries of the Pacific Coast," states that "Capt. John

Reed reported that often when waiting outside the harbor to tow vessels in, on or near the fishing bank, he has caught a fine lot of fish. Frequently halibut are taken, and on one occasion 22 were caught in a few hours fishing with hand lines over the rail; the largest weighed 87 pounds." Regarding the banks, Capt. Collins says they "are located outside the harbor heads, about 10 miles offshore in a northwesterly direction from the whistling buoy off the entrance. There is a depth of 30 fathoms * * * with a gravelly and rocky bottom." The other fishes listed by Capt. Collins were taken by the *Albatross* in 1888–89 and in 1914.

YIELD OF THE BANKS.

Halibut.[a]—So far as possible, a detailed record was kept of all commercial fishing trips made off the Oregon coast during approximately the period covered by the present investigation. The data obtainable (tables III and IV) are for the period beginning May 10, 1914, the date of the first trip of the year, and ending about September 15 with the last, so far as could be ascertained.

An inspection of table III shows that a total of 853,300 pounds of halibut were caught in 1 steamer and 20 schooner trips. Of this total, 235,000 pounds were thrown out as mushy, leaving a total of 618,300 pounds of sound, marketable fish, for which a value of $23,646.25 was received. To these returns there might be added, in computing the year's yield of the bank, over 10,000 pounds taken by the *Albatross* during the survey and about 6,000 caught, it is estimated, by local Newport craft during the fishing season. There were also several trips made to the banks concerning which no definite information could be had, but which, if known, might have materially increased the total given above. Among these were two made in August, one by the steamer *Starr* (12 dories) and the other by the schooner *La Paloma* (4 dories), both of Seattle.

In table IV separate columns have been devoted to totals and averages inclusive of mushy fish. Statistics published in Seattle apparently give the total fare, inclusive of mushy fish, for which there was no sale, thus crediting the vessels with a fare greater than that for which actual value was received. For purposes of comparison these data are also included in tables III and IV. For the months of May, June, and July no averages were drawn, as practically no figures were obtainable with respect to mushy fish. In the August returns the lack of one or two complete reports has resulted in giving a figure which errs on the side of being too low, but the average for the month has not been omitted, as it doubtless very nearly approximates the truth. The September returns are complete so far as they could be secured, but toward the end of the season the fishermen became uncommunicative as to the locality of their operations.

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[a] The halibut yield herein discussed deals with that from the Newport Bank only, as this was the only place where they were caught by commercial fishermen.

To give an idea of the relative abundance of halibut on the Newport Bank and on the Alaska banks, the yield of the former is compared with the total landings in Seattle during the two months for which the most complete statistics were obtainable, namely, August and September. The Seattle statistics[a] for 1914 include not only the Alaska catch but also the Oregon trips landed at that port, and as the comparison is not quite accurate, the returns for 1913, when no Oregon halibut were landed there, have also been cited. On the other hand, the quantity of halibut from Newport Bank taken to Seattle in 1914 was so small compared with the total receipts, that the average catches based on these data are sufficiently accurate for the purposes of this report.

In August, 1914, the average schooner trip (inclusive of mushy fish) from Oregon was 42,800 pounds, 3,000 pounds less than the average schooner fare landed at Seattle during the same month. Compared with the average trip for the same month of the previous year, the Oregon catch was about 100 pounds greater

In September the average trip from Newport Bank exceeded by over 15,000 pounds the average of all schooner trips landed in Seattle in September in either year. The average catch of sound fish alone from off Newport during this month compares favorably with the average Seattle fare including mushy fish, being 34,667 as against 38,343 pounds at Seattle in 1914 and 38,657 pounds in 1913. The Seattle averages are based on 38 trips in 1913 and 70 in 1914; whereas the Newport data include but 6 trips.

To all appearances, within the fishing area off Newport, halibut are as plentiful, at least in August and especially in September, as on the various northern banks fished by the Seattle schooners. It may be said that with the great number of northward trips there is greater possibility for making poor ones; but a few of these would not materially reduce the Seattle average, based on so many trips, whereas a few from Newport would have reduced that average to an insignificant quantity.

Relative to the time taken in making trips off Newport, in August the *Decorah* (4 dories) caught fish at the rate of 10,000 to 11,000 pounds a day; during the early part of the same month the *Daisy* (3 dories) secured a trip of about 40,000 pounds in a little over three days; later the *America* (4 dories) arrived off Newport August 14 and returned to Seattle August 21 with 57,000 pounds, taking 13,000 pounds on her best day; and the *Alaska* (8 dories), beginning to fish off Newport on August 17, took a fare of slightly over 80,000 pounds into Seattle on August 24.

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[a] The Alaska landings are practically all from the various well-known Alaskan fishing banks, though a number of the smaller fares are still obtained off Cape Flattery.

Though doubtless the entire Seattle fleet could clean out the Newport grounds in one or two trips, there is every indication that it will easily yield twice to three times the number of trips made thereon during July, August, and September, and possibly as early as May and June there may be a good run on certain spots indicated on the edge of Heceta Bank.

Regarding the percentage of mushy fish taken off Newport as compared with catches made in Alaskan waters, there are very few figures available. Of the four Newport trips made in August for which we have complete data, from 23 to 31 per cent, and in one fare of 57,000 pounds 43 per cent, were mushy. In September, taking all of the returns into consideration, about 37 per cent of the fish were mushy. Of Alaskan trips, but two of which can be cited here, both from the Portlock Bank, one in September of 50,000 pounds, and the other in October of 240,000 pounds, of which 40 and 29 per cent, respectively, were mushy.

These fish, called at times milk halibut, have been variously described. The fishermen say that when cut the flesh is so soft that it can be shaken away from the skin and bones, a condition that does not make itself apparent until after the fish has been packed in ice for several days or more. Mr. A. B. Alexander, of the Bureau of Fisheries, says that when mushy fish are cut they exhibit sac-like bodies in the muscular tissue varying in size from that of a marble to a walnut, of the consistency of hard fat, and which, when ruptured, exuded a whitish fluid of the consistency of condensed milk. Fish so affected are mushy to the touch, the flesh does not return to the original shape after being subjected to pressure, as from a finger end.

Several theories as to the causes of this condition have been advanced. One is that related to spawning, but the facts do not appear to support this idea. The suggestion that it is due to disease, or rather parasitism, seems more probable. Dr. Johan Hjort gives the results of a study of the life history of a crustacean parasitic in the flesh of *Molva abyssorum*, commonly known as the ling in Europe, and of very common occurrence on halibut banks. About 3 per cent of the ling taken are infected with the parasite, which has a whitish or yellowish egg-shaped body about the size of a walnut (1¾ by ⅞ inches) filled with a blackish fluid (digestion products) which, when the animal is cut, contaminates the flesh of the fish, rendering it unfit for sale. It is possible that the mushy halibut may have a similar causation, as Mr. Alexander speaks of the occurrence of hard, fatty lumps in their flesh.

This matter might well be made a subject for research, as unfortunately no way of detecting the affected fish at the time of taking has been discovered. Only after the fish have been in ice for several days, or upon cutting them, is the mushiness apparent, and for fish so cut there is at present no sale.

Red rock-cod.—This fish, more properly called red rockfish, which is especially abundant on Heceta Bank, is common throughout the region surveyed and was taken practically at every set of the fishery gear. It is not marketed by the halibut vessels, but is taken by the local fishermen, it is found in the markets of Seattle and especially San Francisco, and from the latter place it is shipped to more or less distant interior points. It is excellent both as a pan fish and for chowder, and the demand for it should increase.

Black cod.—As far as indications go, black cod can profitably be fished in the deep water just off the southern and western slopes of Heceta Bank.

Flounders, sole, etc.—Of the smaller flatfishes, there seems to be an untold wealth throughout the greater part of the region surveyed. One needs but to refer to the records of the earlier *Albatross* investigation and to the returns of several of the fishing ventures, listed in the "Résumé of the history of the banks," and the tabulation of the scallop trials in the present report to become convinced of their abundance.

Dogfish.—Though not properly considered a commercial fish at the present time, the question of the utilization of dogfish for fertilizer and other purposes renders notes regarding their occurrence and abundance of more than passing interest.

From the results of the *Albatross* trials and the reports of the fishermen, there seems to be a more or less defined spring and summer run. In the course of the various sets, dogfish were taken rather more frequently in April, May, and September than during the intervening months of July and August, although on one occasion in the latter month 28 were taken, the greatest number to one skate of gear.

At practically all times the dogfish proved a great nuisance. The *Idaho* spoke of taking great numbers of them at every prospect in the spring of 1913. Capt. Tanner was also impressed by their abundance in 1888.

Whales.—At Grays Harbor the American Pacific Whaling Co. operates the only shore whaling station located on the coast, conducting operations between Cape Lookout and Cape Flattery. In 1912, 261 whales were taken and in 1913, 211, of which 6 were sperm whales. During the last *Albatross* trip, August 27 to September 10, one or more whales were sighted each day, and on August 29, a school of about 10 humpbacks was seen, the largest of which had a spread of about 30 feet between the tips of the flukes. Another small school was noted on September 5.

Scallops.—From time to time the taking of scallops off Newport has been reported, and in connection with the present investigation trials were made for them as opportunity presented. The first evidence of their occurrence obtained by the *Albatross* was at set VI, May 7, when several sea anemones attached to large scallop shells were brought up on the trawl line. As the weather was too foggy and threatening to warrant the towing of apparatus over the bottom in such close proximity to shore, the dredge was not used at the time, and it was not until July 20 that a scallop trial was made. At first an improvised dredge with a galvanized iron (chicken) wire bag, and later a light oyster dredge with a similar bag, was employed, the opening in each having an effective width of 3 feet.

During three days in the latter part of July, while working out of Newport, eight tows of varying duration were made with the oyster dredge, yielding but three living scallops, 3, 6, and 7 inches, respectively, in diameter. During one of the hauls a living scallop 6 inches in diameter was picked up on a hand line which was dragging over the bottom. The evidence of the occurrence of scallops thus obtained was, though positive, very scanty, and five hauls made in this vicinity by the *Albatross* with the oyster dredge and a 9-foot Agassiz beam trawl were wholly unproductive. Though failures so far as scallops were concerned, these hauls demonstrated a great abundance of flounders and soles. In four of them, of between 15 and 20 minutes duration each, over 300 small flatfish were taken all told, of which 187 were sand dabs (*Citharichthys sordidus*). These hauls confirm the results of the early fishing ventures off the Oregon coast and are indicative of an abundance of the species listed in the summary of the scallop trials, table II.

As mentioned above at set VI, May 7, off Cascade Head, several dead scallop shells were brought up on the halibut trawl. Four tows were made in this vicinity on September 3. In the first (VI) 50 living scallops were caught, 30 ranging from $4\frac{1}{2}$ to 6 inches, the remainder from $2\frac{1}{4}$ to 4 inches. The second haul (XLI), 2 miles farther inshore, yielded 3 small living scallops. At the third (XLII), about a mile to the southeast of the first, no scallops were caught, and at the fourth (XLIII), about a mile north of the first, 15 living scallops, 2 large and 13 small, were taken.

The results point to the existence of a scallop bed extending over at least 2 square miles. When considered with the few scattered individuals picked up off Newport and several specimens in the National Museum labeled as having come from the Siuslaw River, Oreg., they indicate that a more detailed search than it was possible to make in connection with this halibut investigation will reveal one if not several scallop beds of sufficient extent to warrant establishing along the Oregon coast a fishery similar to that for the giant scallop off the coast of Maine. The depth of water, 50 to 60 fathoms, is greater than on the Maine beds; but the use of small gasoline winches make the depth of less moment than when the dredges were wound in by hand. Scallops to a certain extent are migratory, which must be taken into consideration by anyone contemplating undertaking a market fishery. A possible lack of a wide demand on the west coast is also a factor requiring careful investigation, notwithstanding that scallops are quoted in Seattle markets at a price at times as high as $3 a gallon.

The living adult scallops taken during the investigation averaged four to the pound, shell included. The eyes or muscles, which are the edible portion, were from 1 to 1½ inches in diameter and about ½ inch thick, and weighed, fresh, approximately 16 to the pound. All told, 17 hauls were made for scallops, the data for which are set forth in table II.[a]

SUMMARY.

The investigation developed the existence of a nice run of halibut during a period of at least two months, on a bank having an area of approximately 250 square miles, off Newport, Oreg. The run attained its maximum in August and September, but fish were present in June and July. A profitable fishery probably could be conducted at that time, and at certain places might possibly be engaged in as early as the latter part of April. Irrespective of the abundance of fish, however, the weather conditions and lack of shelter will restrict fishing to the period from April to September. In 1914 this run yielded commercial catches totaling over 850,000 pounds of halibut in 21 trips, for which $23,646.25 was received by the fishermen. Average trips of 40,000 pounds were caught in four days or less, the fish averaging 27 pounds in weight.

Mushy fish occur to the extent of 30 to 40 per cent of the total catch, but in view of certain returns from Alaska during the same year (1914), this proportion does not seem greater than on other Pacific coast grounds.

Halibut may be expected in limited quantities off Coos Bay, on a considerably smaller and less developed patch of bottom, and possibly off Grays Harbor at some season of the year, as a good piece of bottom was located in that vicinity, although not a halibut was caught thereon. With respect to halibut and halibut bottom, the section of the coast lying off Tillamook seems to be the least favorable.

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[a] For a detailed account of scallops and scallop fisheries see:

Smith, Hugh M.: The giant scallop fishery of Maine. Bulletin U. S. Fish Commission, vol. IX, 1889, p. 313-335.

Belding, David L.: A report upon the scallop fishery of Massachusetts. Published as a special report by the Commonwealth of Massachusetts, 1910, 150 pages.

Both papers are well illustrated, a chart accompanying the former.

On the other hand, throughout practically the entire reach of the Oregon coast, there seems to be an abundance of the smaller flatfishes, some of which are food fishes of great excellence. The red rock-cod and doubtless black cod occur in great abundance. Dogfishes are so numerous at times as to be a nuisance.

Scallops apparently are to be found over a wide range of territory and in some places probably form beds thickly enough populated to warrant fishing, though the depth in which they lie may militate against taking them commercially.

In conclusion, the harbor and market facilities, bait supplies, transportation, and cold storage are perhaps too limited and uncertain to enable any of the Oregon coast ports to become fishing centers of any great consequence under present conditions. The limitation of the fishing season by weather conditions is possibly the greatest handicap in competition with Seattle and its proximity to the vast, year-round Alaska fishery resources. No doubt the Newport Bank will provide a valuable addition to the available supply of halibut, and the greater part of the Oregon coastal region will furnish a future source of supply of flounders, sole, black cod, and red rockfish, which at present find but a limited market, if any.

TABLE I.—LOCATIONS AND RESULTS OF HALIBUT FISHING TRIALS OFF THE COAST OF WASHINGTON AND OREGON BY THE STEAMER ALBATROSS, 1914.

[illegible]	Position	Date	[illegible]	Character of bottom a	[illegible]	Bait	[illegible]	[illegible]
I	Heceta [illegible]	[illegible]	[illegible]	Shale, [illegible] blk S, [illegible]	[illegible]	[illegible]	[illegible]	[illegible]
II	Off Newport (Yaquina Light bears [illegible], distant 19.8 miles).	M[illegible]	[illegible]	Gn M; fne blk S...	[illegible]	[illegible]	[illegible]	[illegible]
III	Heceta Bank (Heceta Light bears E. ½ N., distant 29.2 miles).	May 5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
IV	Off Newport (Yaquina Light bears N. ¾ E., distant 13.7 miles).	May 6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
V	Off Newport (Yaquina Light bears [illegible] by E. ½ E., distant 14.4 miles).	...do....	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Double-banked set. [illegible] long, stomach contents saved. C[illegible] 39 in. long; two 22 lbs., 39½ in. long [illegible] 3 red rock cod, 1 ling cod, 1 rock [illegible] lines.
VI	Off Cascade Head (Cape Kiwanda bears N. ½ E., distant 12.7 miles).	May 7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Double-banked set. Sole, 1½ lbs.; 2 red r[illegible]ger), 6 lbs., 22 in. long. Cultus c[illegible], 11 l[illegible] stomach contents saved. Skates, [illegible] one 30 lbs., 54 in. long. On trawl: [illegible] shells, 1 Pycnopodia (many-rayed starfish).
VII	Off Columbia River (Tillamook Light bears NE. by E. ½ E., distant 25.1 miles).	May 8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Double-banked set. 1 octopus. [illegible]; two 15 lbs., 42 in. long. [illegible] On trawl: 1 starfish.
SECOND ALBATROSS TRIP								
VIII	Off Newport (Yaquina Light bears N. ½ E., distant 10.8 miles).	May 27	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Cultus cod, 11 lbs., 33 in. long. On trawl: 6 pennatulids, 2 starfishes
IX	Heceta Bank (Heceta Light bears [illegible]).	May 28	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
X	Heceta Bank (Heceta Light [illegible] NE. ½ N., distant 30 miles).	[illegible]	[illegible]	[illegible]	[illegible]	...do...	[illegible]	Double-banked set. Black cod averaged 10.6 lbs., range 7-18 lbs., 8 very small; 18 lbs., 35 in. long, 12 lbs., 32 in. long, 10 lbs., 31 in. long; 7 lbs., 26 and 22 in. long.
XI	Heceta Bank (Heceta Light bears NE. by E., distant 31.6 miles).	May 29	[illegible]	[illegible]	[illegible]	...do...	[illegible]	Double-banked set. Black cod averaged 12 lbs., range, 5-16 lbs.; 16 lbs., 33 and 36 in. long; 15 lbs., 36 in.; 8 lbs., 28 in.; 5 lbs., 22 in. Shark approximately, 48 in. long.
OPERATIONS CONDUCTED OUT OF NEWPORT								
XII	Off Newport (approximately as indicated on chart).	July 13	[illegible]	[illegible]	[illegible]	[illegible], salt herring	[illegible]	2 [illegible] on hand lines. On trawl: [illegible]
XIII	Do.	July 14	[illegible]	[illegible]	[illegible]	Clam, salt herring	[illegible]	[illegible] taken on hand lines; no [illegible] pennatulids, 2 anemones.
XIV	Do.	July 20	[illegible]	[illegible]	5	....do....	[illegible]	[illegible]
XV	Do.	...do....	[illegible]	[illegible]	3	Surf perch, salt herring.	[illegible]	17 | 1 live (6 in.) scallop on hand line; 5 halibut, 4 red roc[illegible] and 3 soles taken on hand lines, 1 dogfish, 42 in. l[illegible] 1 pennatulid, 1 anemone, 4 starfish, 4 Pycnopodia (m[illegible] rayed starfish).
XVI	Do.	July 23	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5 | 1 pennatulid, 5 starfish, 4 Pycnopodia (many-rayed [illegible]fish), 5 anemones.
XVII	Do.	July 24	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3 | 1 live (6 in.) scallop taken with oyster dredge, 15 min. [illegible] 2 other tows, 15 and 30 mins. respectively, unsuccess[illegible] 2 halibut and 2 red rockfish taken on hand lines; 6 pe[illegible]natulids, 2 Pycnopodia (many-rayed starfish).
XVIII	Do.	July 25	[illegible]	[illegible]	2	Frozen herring....	[illegible]	5 dogfish, 2 skates, and 1 red rockfish taken on hand lines; 1 skate, 48 in. wide; 1 octopus, arms 54 in. long; 2 Pycnopodia (many-rayed starfish).
XIX	Off Newport (approximately as indicated on chart).	July 27	[illegible]	[illegible]	[illegible]	Octopus, salt herring.	[illegible]	[illegible] halibut taken on hand line; 1 Pycnopodia (many-rayed [illegible]fish).
XX	Do.	July 28	[illegible]	[illegible]	[illegible]	Salmon, salt herring.	[illegible]	4 Pycnopodia (many-rayed starfish)
XXI	Do.	Aug. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	30 pennatulids; 2 Pycnopodia (many-rayed starfish)
XXII	Do.	Aug. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2 live (3 and 7 in.) scallops taken with oyster dredge, 20-min. tow; 2 other tows, 40 and 45 mins. each, both unsuccessful; 6 Pycnopodia (many-rayed starfish), 1 anemone
XXIII	Do.	Aug. 14	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	40-min. tow with oyster dredge unsuccessful; 8 pennatulids.
XXIV	Do.	Aug. 15	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2 rocks, honeycombed, full of life; 1 Pycnopodia (many-[illegible]starfish).
XXV	Do.	Aug. 16	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1 Pycnopodia (many-rayed starfish).
XXVI	Do.	Aug. 17	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1 halibut, [illegible] on hand line[illegible]
THIRD ALBATROSS TRIP.								
XXVII	Off Coos Bay (Umpqua River Light bears N. ½ E., distant 8.2 miles).	Aug. 29	[illegible]	[illegible]	[illegible]	[illegible]	16.0 2 16.0 3 1	Double-banked set. Soles, 18, 19, and 22 in. long. 1 starfish
XXVIII	Off Coos Bay (Cape Arago Light bears NE. ½ E., distant 9 miles).	Aug. 30	65	Shale, gran...	[illegible]	[illegible]	24.2 4 2	Double-banked set. One shark was "soup fin" (*Galeorhinus zyopterus*); blue shark, 56 in. long.
XXIX	Off Coos Bay (Cape Arago Light bears SE. ½ S., distant 2.7 miles).	...do....	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Double-banked set.
XXX	Off Coos Bay (Cape Arago Light bears SSE. ½ E., distant 5.5 miles)	Aug. 31	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Double-banked set. One shark was "soup fin" (*Galeorhinus zyopterus*)
XXXI	Off Heceta Head (Heceta Light bears N. ½ E., distant 10.8 miles)	...do....	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Double-banked set
XXXII	Heceta Bank (Heceta Light bears NE. by E., distant 31.4 miles).	Sept. 1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
XXXIII	Heceta Bank (Heceta Light bears E. ¾ N., distant 32.1 miles).	...do....	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Double-banked set. Black cod averaged 16 lbs., [illegible] long; 1 basket (cup) sponge
XXXIV	Off Newport (Yaquina Light bears NE. ½ N., distant 20.7 miles).	Sept. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Double-banked set. One silver salmon taken on gear.
XXXV	Off Cascade Head (Cape Kiwanda bears N. ½ E., distant 13.8 miles).	Sept. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Double-banked set
XXXVI	Off Tillamook (Cape Meares Light bears SE. ½ E., distant 9.4 miles).	Sept. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Double-banked set. One arrow-toothed halibut (*Atheresthes stomias*) taken on gear
XXXVII	Off Tillamook (Tillamook Light bears N. by E. ¾ E., distant 8.2 miles).	...do....	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Double-banked set
XXXVIII	Off Gray's Harbor (Cape Shoalwater Light bears ESE. ½ E., distant 20.9 miles).	Sept. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1 silver salmon take on gear; 3 anemones.

a Abbreviations descriptive of the bottom: blk, black; brk, broken; crs, coarse; fne, fine; G, gravel; gn, green; gran, granular; gy, gray; hd, hard; M, mud; rky, rocky; S, sand.

b Also 1 line, flounder gear.

c Four rocks.

TABLE II.—LOCATIONS AND RESULTS OF TRIALS FOR SCALLOPS OFF THE COAST OF WASHINGTON AND OREGON BY THE STEAMER "[illegible]

Number of trial	Position.	[illegible]	[illegible]	Character of bottom a	[illegible]	Length	Scallops (Pecten caurinus Gld.) taken: Total, living	Scallops (Pecten caurinus Gld.) taken: Large	Flounder taken: Sole (Psettichthys melanostictus)	Addenda
OFF NEWPORT.										
XV	Approximately as located on chart	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	1 large jelly fish.
XV[illegible]	Do.	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	..	1 (6 in.) living scallop brought up on hand line during this haul; several worm tubes
X[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	..	6 inch
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	
XX	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	
XI	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	
XXII	D[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	
XXII	Do.	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	Large scallop, 7 in.; small scallop, 3 in.; 1 starfish and worm tubes.
[illegible]	Yaquina Light bears NE. ½ N., distant 6.4 miles	[illegible]	[illegible]	[illegible]	[illegible]	1 mile....	[illegible]	[illegible]	12	Hermit crabs, algæ, worm tubes, starfishes.
XVII	Yaquina Light bears NE. by E., distant 8 miles	[illegible]	[illegible]	[illegible]	[illegible]	1 mile.....	[illegible]	[illegible]	[illegible]	Worm tubes, algæ, mollusca, 1 brittle starfish.
XXII	Yaquina Light bears ENE. ½ E., distant 5.1 miles	[illegible]	[illegible]	[illegible]	[illegible]	1 mile..	[illegible]	[illegible]	[illegible]	1 tomcod, 1 smelt, 7 young black cod, 13 starfish, barnacles, 1 sea-slug, dead shells, 1 crab, 1 hermit crab.
[illegible]	Yaquina [illegible] 2.8 miles	[illegible]	[illegible]	[illegible]	[illegible]	0.7 mile	[illegible]	[illegible]	[illegible]	3 starfish, 1 leech, pieces Polynices egg case.
XXXIX	Yaquina Light bears NE. ¾ E., distant 4 miles	[illegible]	[illegible]	[illegible]	[illegible]	1 mile	[illegible]	[illegible]	[illegible]	1 shark egg case, 1 Polynices egg case, 3 Polynices, living shells, 12 hermit crabs, 5 starfish, several pennatulids, 1 dead Schizothaerus valve.
OFF CASCADE HEAD										
VI	Cape Kiwanda bears N. ¾ E., distant 12.2 miles	[illegible]	[illegible]	[illegible]	[illegible]	1 mile..	[illegible]	[illegible]	[illegible]	28 starfish, anemones, crustaceans, worm tubes, mollusks, worms
XLI	Cape Kiwanda bears N., distant 10.5 miles	[illegible]	[illegible]	[illegible]	[illegible]	1 mile...	[illegible]	[illegible]	4	15 starfish, 1 dead Schizothaerus valve
XLII	Cape Kiwanda bears N. ½ W., distant 13.5 miles	[illegible]	[illegible]	[illegible]	[illegible]	1 mile.	[illegible]	[illegible]	10	2 C. magister (crabs), 1 skate, 1 starfish, 1 anemone.
XLIII	Cape Kiwanda bears N. by E., distant 10.1 miles	[illegible]	[illegible]	[illegible]	[illegible]	1 mile..	[illegible]	[illegible]	.	1 young black cod, 11 starfish, 1 nudibranch

a Abbreviations descriptive of the bottom: blk, black; brk, broken; crs, coarse; fne, fine; G, gravel; gn, green; gran, granular; gy, gray; hd, hard; M, mud; rky, rocky; S, sand.

TABLE III.—QUANTITY AND VALUE OF HALIBUT CAUGHT BY COMMERCIAL FISHERMEN OFF THE COAST OF OREGON, MAY 10 TO SEPTEMBER 15, 1914.

Date.	Vessel.	Landed at—	Sound fish.	Price per pound.	Value received.	Mushy fish.	Total catch.
			Pounds.	*Cents.*		*Pounds.*	*Pounds.*
May 10	Decorah	Portland	4,500	3	$135.00	Unknown.	4,500
28	do	do	13,700	4	548.00	Unknown.	13,700
June 16	do	do	22,800	3	684.00	Unknown.	22,800
July 6	do	do	32,500	3¼	1,056.25	Unknown.	32,500
11	Daisy	Newport	19,000	3¼	617.50	Unknown.	19,000
16	do	Seattle	30,000	5½	1,650.00	5,000	35,000
22	Decorah	Portland	21,000	4	840.00	Unknown.	21,000
30	Daisy	Newport	17,000	5½	935.00	Unknown.	17,000
Aug. 10	Decorah	Portland	14,000	3¼	455.00	Unknown.	14,000
12	Daisy	Seattle	27,800	4¾	1,320.50	12,000	39,800
21	America	do	32,000	3¼	1,040.00	25,000	57,000
22	Decorah	do	30,000	3	900.00	Unknown.	30,000
24	Alaska	do	56,000	3¾	2,130.00	25,000	81,000
25	Daisy	do	27,000	4	1,080.00	8,000	35,000
Sept. 1	San Juan	do	60,000	3½	2,100.00	50,000	110,000
5	Athena	do	54,000	3½	1,890.00	27,000	81,000
7	Senator	do	28,000	3¼	910.00	15,000	43,000
8	Magnolia	do	30,000	3¼	975.00	10,000	40,000
11	Panama	do	46,000	3	1,380.00	22,000	68,000
15	Omaney	do	40,000	4¼	1,700.00	10,000	50,000
—	Daisy	San Francisco	13,000	10	1,300.00	26,000	39,000
Total (21 trips)			618,300	....	23,646.25	235,000	853,300

TABLE IV.—QUANTITY OF HALIBUT CAUGHT (SCHOONERS ONLY) ON THE NEWPORT BANK, MAY TO SEPTEMBER, 1914, AND THE AVERAGE CATCH PER TRIP COMPARED WITH THE AVERAGE CATCH PER TRIP LANDED AT SEATTLE FROM ALL BANKS IN 1913 AND 1914.

Month.	Newport, 1914.					Seattle.	
	Number of trips.	Sound fish.	Average trip based on sound fish.	Total fish, sound and mushy.	Average trip based on total fish.	Average trip based on total fish, sound and mushy.[b]	
						1913	1914
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
May	2	18,200	9,100	(a)	(a)	....	....
June	1	22,800	22,800	(a)	(a)	....	....
July	5	119,500	23,900	(a)	(a)	....	....
August	6	186,800	31,133	[a] 256,800	[a] 42,800	42,729	45,701
September	6	208,000	34,667	321,000	53,500	38,657	38,343

[a] Returns of mushy fish are incomplete in a number of instances, hence figure given is not sufficiently high. Averages and totals, owing to number of such omissions, have not been included in returns by months for May, June, and July.

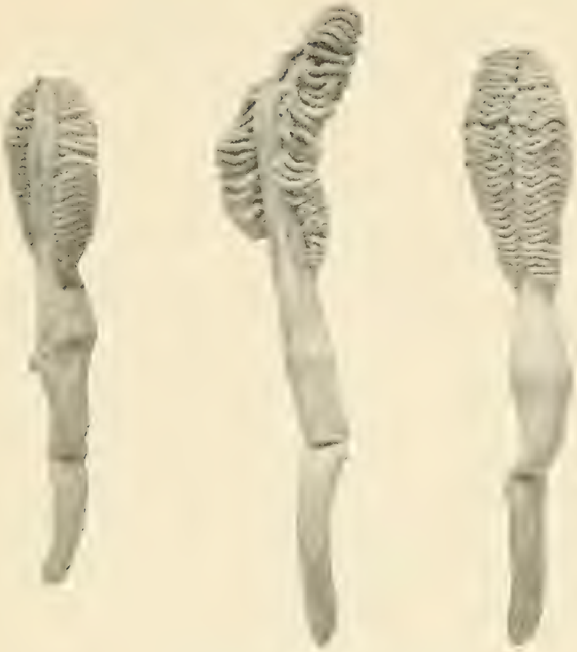
[b] Taken from the Pacific Fisherman.

EXPLANATION OF CHARTS.

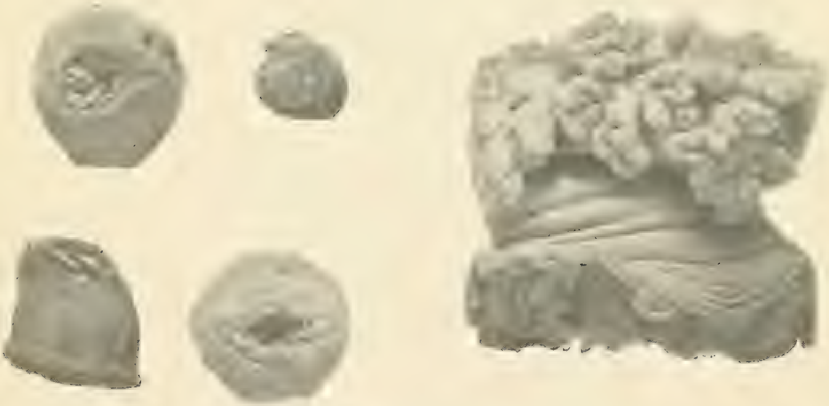
The character of the bottom is indicated by stippling in three colors, the significance of which is explained on the charts, but the following further explanation of the terms appears advisable. Shale is a siliceous (sandy) or calcareous (limey) hard pan, which occurs as honey-combed bowlders or easily crumbled rocks (designated in this report as rocky) as a species of gravel (described as granular shale) and as a hard mud. Broken bottom consists of mixed materials, shale, gravel, sand, and mud, in patches of varying sizes and composition, but always rich in bottom-living organisms.

The depths are indicated by curves drawn at 10-fathom intervals, but the soundings which have been made off this coast are not sufficiently numerous to permit more than approximate location of the lines in many cases.

The locations of the sets made during the survey are shown by Roman numerals (I to XLIII), the center of the space covered by the numeral being the position of the set. Fishing trials made by the *Idaho* and the *Chicago* prior to the investigation are shown by numbered rectangles and circles, respectively.

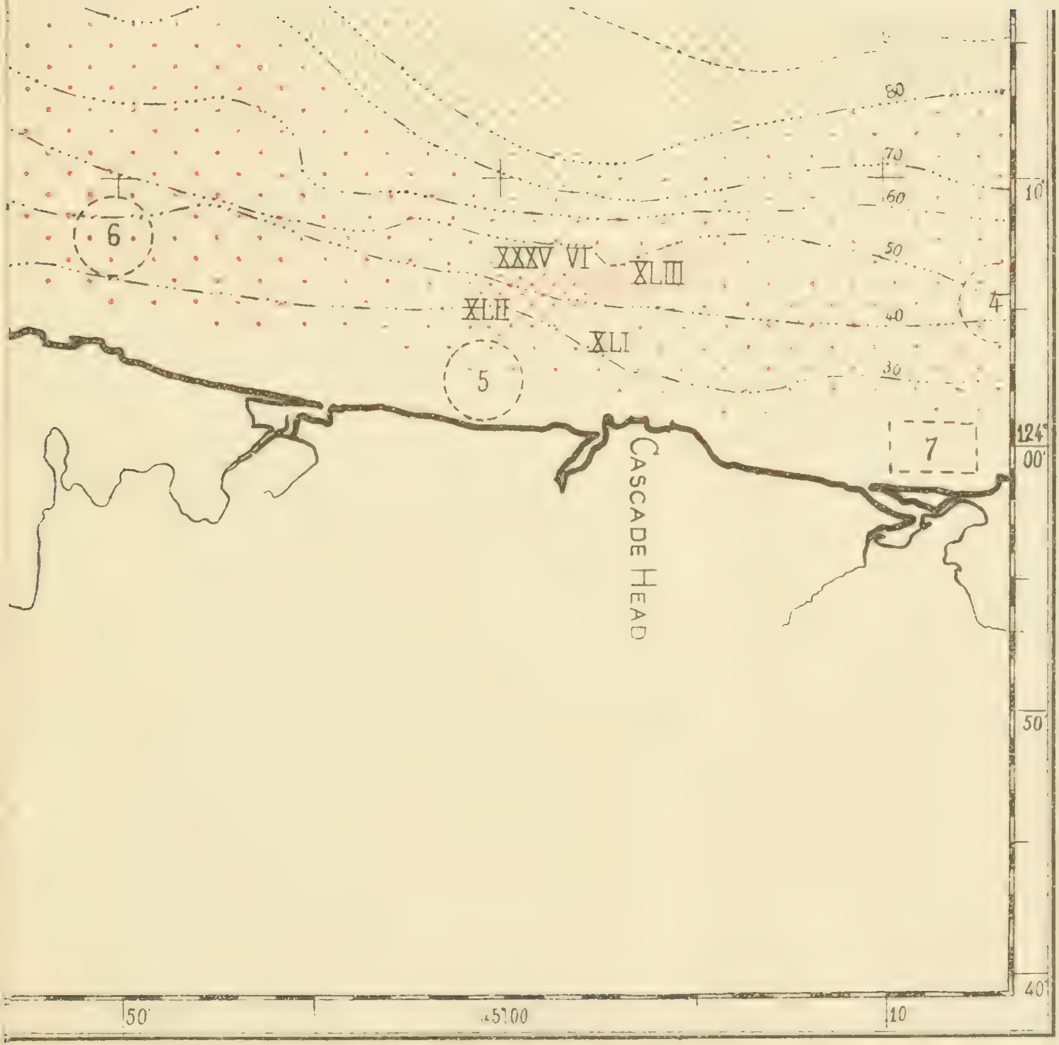


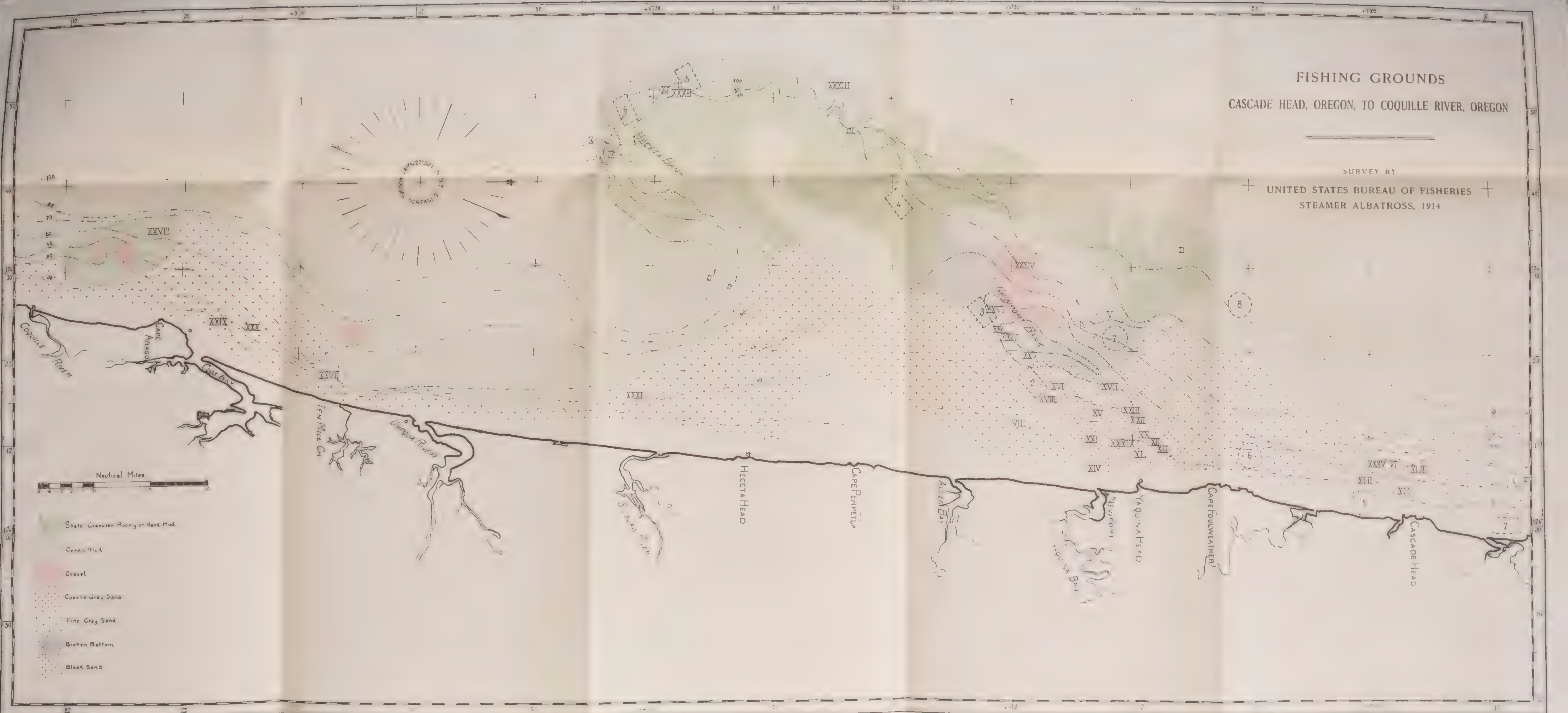
1. PENNATULIDS (PENNATULA SP.).



2. SEA ANEMONES (CRIBRINA SP.) (METRIDIUM SP.).

Scanned? Y / N


80
70
60
50
40
30
6
5
4
7
XXXV
VI
XLIII
XLII
XLI
CASCADE HEAD
10'
124°
00'
50'
40'
50'
45°00
10



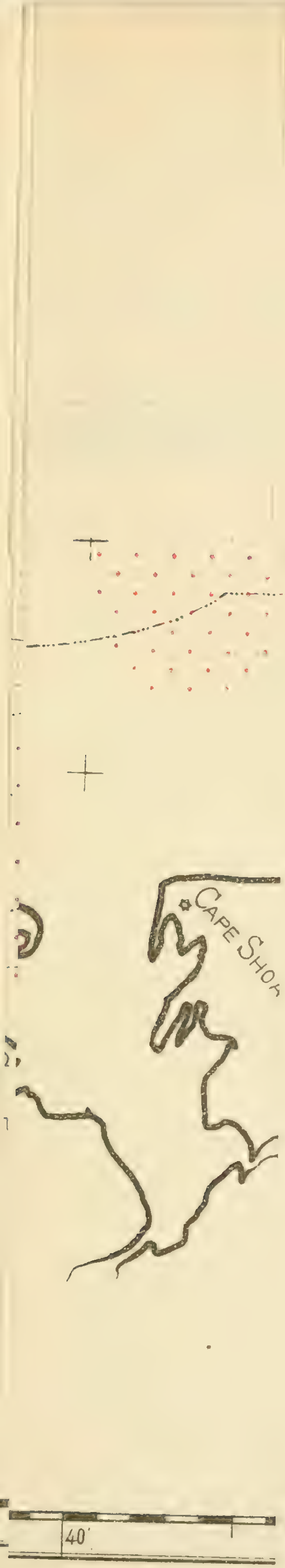
FISHING GROUNDS

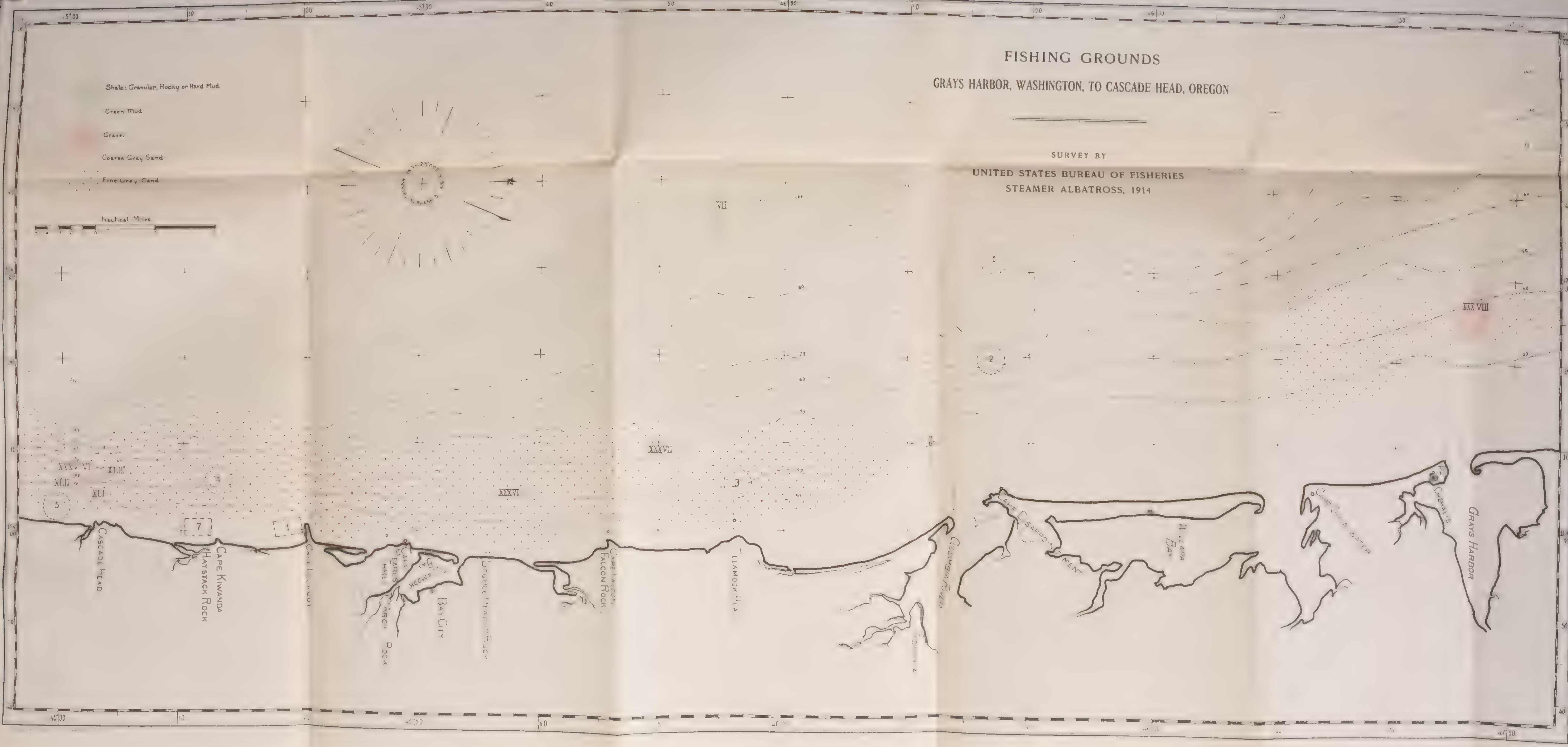
CASCADE HEAD, OREGON, TO COQUILLE RIVER, OREGON

SURVEY BY

UNITED STATES BUREAU OF FISHERIES

STEAMER ALBATROSS, 1914


CAPE SHOR
40'



FISHING GROUNDS

GRAYS HARBOR, WASHINGTON, TO CASCADE HEAD, OREGON

SURVEY BY

UNITED STATES BUREAU OF FISHERIES

STEAMER ALBATROSS, 1914

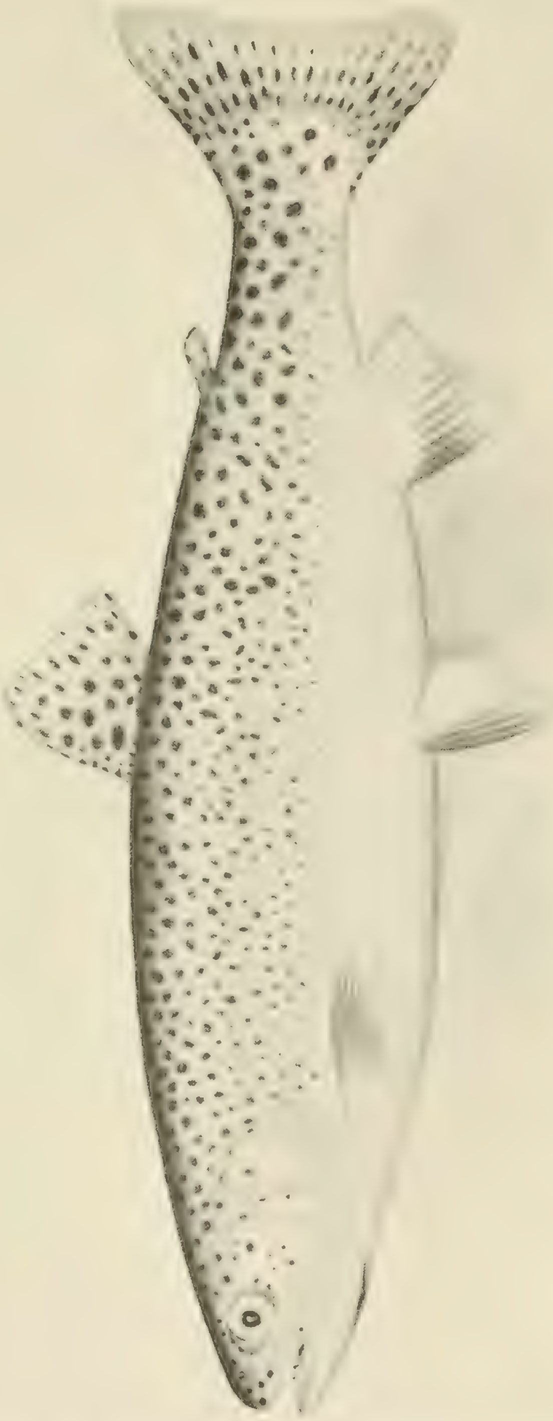


FIG. 3.—NATIVE TROUT; CUTTHROAT TROUT; BLACKSPOTTED TROUT.

THE FISHES OF THE YELLOWSTONE NATIONAL PARK

By W. C. Kendall
Assistant, United States Bureau of Fisheries

Appendix VIII to the Report of the U. S. Commissioner
of Fisheries for 1914

THE FISHES OF THE YELLOWSTONE NATIONAL PARK.

By W. C. Kendall,
Assistant, U. S. Bureau of Fisheries.

INTRODUCTION.

The natural fish fauna of the Yellowstone National Park consists of but a few species, owing to the facts that distribution must have occurred in recent geological times and that all of the streams leaving the lava beds do so by means of vertical waterfalls situated in deep canyons. Except in Yellowstone River and its tributaries, in Gibbon River, and in Lava Creek, no fishes have been found above these falls except where their presence may be accounted for by imperfect watersheds separating these streams from others.

The known species of natural occurrence in the park are longnose sucker, rosyside sucker, chub, silverside minnow, longnose dace, whitefish, cutthroat trout, grayling, and blob. Of these only the trout and grayling were recognized as game fishes, although the whitefish might justly be so considered. While these fishes were wonderfully abundant in the waters inhabited by them, the annually increasing number of tourists, many of whom were anglers, made it desirable to stock some of the previously barren waters with game fishes.

An examination of the park waters by Forbes in 1890[a] showed that many of these waters were well supplied with crustacean and insect food and were otherwise suited to certain species. Referring to the supposed obstacle to the spread of fish life in the park, Dr. Jordan said that the waters of the geysers and other calcareous and silicious springs appeared not to be objectionable to fishes. In Yellowstone Lake trout were found especially abundant about the overflow from the Lake Geyser Basin, where the hot water flowed for a time at the surface, and trout could be taken immediately under these currents. It was noted also that trout had been known to rise to a fly through the scalding hot surface current and that they lingered in the neighborhood of hot springs in the bottom of the lake. Dr. Jordan suggested that this was probably owing to the abundance of food in those warm waters, but the fact is evident that geyser water does not kill trout. Heart Lake was also mentioned where trout were found most plentiful about the mouth of warm Witch Creek and in Boiling River, which drains the Mammoth Hot Springs and flows into Gardiner River, where trout abounded about the mouth, and where the conventional trick of catching a trout in cold water and scalding in hot water is possible.

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[a] A preliminary report on the aquatic invertebrate fauna of the Yellowstone National Park, Wyo., and the Flathead region of Montana. By S. A. Forbes. Bulletin U. S. Fish Commission, vol. XI, for 1891, p. 207-258, and pl. XXXVII-XLII. 1893.

The first fish-cultural distributions in the park waters were in 1889, when several species were transplanted and introduced. From that time to the present many fish of various species have been planted, according to available records, as follows:

Native whitefish (*Coregonus williamsoni*)	12,980
Native trout (*Salmo clarkii*)	9,009,968
Rainbow trout (*Salmo irideus*)	61,390
Loch Leven trout (*Salmo levenensis*)	17,195
Landlocked salmon (*Salmo sebago*)	9,000
European brown trout (*Salmo fario*)	9,300
Lake trout (*Salvelinus namaycush*)	42,025
Eastern brook trout (*Salvelinus fontinalis*)	41,650
Largemouth black bass (*Micropterus salmoides*)	750

PRINCIPAL FISHING IN THE PARK.

Of the foregoing, the landlocked salmon and black bass have shown no evidence of their survival, but more or less of the others have become established and some of them abound even in waters previously uninhabited by fish.

In many of the localities the fishing is reported to be excellent, not only for the introduced forms but for native trout, otherwise called blackspotted or cutthroat trout. Where whitefish and grayling naturally occur they are usually plentiful.

The season does not begin much, if any, before July, by which time, according to one of the following authorities, "the plethora of water has disappeared and the streams flow swift, clear, and cold. At this season of the year trout fishing is at its best."

Information regarding the fishing in various localities may be found in the reports of the superintendent of the park, particularly that of 1897, and the following publications:

Fish in the National Park and tributaries of Snake River—propagation of whitefish. By J. E. Curtis. Bulletin U. S. Fish Commission, vol. IV, for 1884, p. 335–336.

A reconnoissance of the streams and lakes of the Yellowstone National Park, Wyo., in the interest of the United States Fish Commission. By David Starr Jordan. Bulletin U. S. Fish Commission, vol. IX, for 1899, p. 41–63, with map and many plates.

A reconnoissance of the streams and lakes of western Montana and northwestern Wyoming. By Barton W. Evermann. Bulletin U. S. Fish Commission, vol. XI, for 1891, p. 3–60, with plates and maps.

A woman's trout fishing in Yellowstone Park. By Mary Trowbridge Townsend. Outing, vol. XXX, no. 2, May, 1897, p. 163–164.

Wyoming summer fishing and the Yellowstone Park. By Ralph E. Clark. Outing, vol. LII, no. 4, July, 1908, p. 508–511.

Fly fishing in wonderland. By Klahowya (O. P. Barnes). 1910. 56 p.

The following annotated up-to-date list of fishing localities is mainly derived from information kindly furnished by Col. L. M. Brett, United States Army, the present acting superintendent of the park, to which a few notes from the previously mentioned writers have been added:

YELLOWSTONE LAKE.

The lake abounds in native trout eager for the fly or other lure. There appears to be no other species in the lake, the landlocked salmon planted in 1908 and 1909 not having been seen since. Rainbow trout planted at the same time in some of the affluents have shown no evidence of establishment.

YELLOWSTONE RIVER ABOVE THE FALLS.

Native blackspotted trout are plentiful. Whitefish planted in 1889 and in 1890 have not been reported.

Cascade Creek.—Native trout are abundant.

YELLOWSTONE RIVER AND BRANCHES BELOW THE FALLS.

Native trout are plentiful and whitefish are native to the waters but seldom found higher up than Crevice Gulch.

Tower Creek.—The waters above the falls were barren previously to the planting of eastern brook, rainbow, and blackspotted trouts, and these have as yet shown no evidence of establishment.

Geode Creek.—Rainbow trout planted in 1909.

Blacktail Deer Creek.—Native trout are abundant and eastern brook trout were planted in 1912, 1913, and 1914.

GARDINER RIVER AND BRANCHES.

The main stream.—Loch Leven trout are found in abundance, probably planted by mistake. Native trout and whitefish are common.

East Fork or Lava Creek.—Blackspotted and eastern brook trouts were introduced and both are abundant. Rainbow trout were also introduced but are not much, if at all, in evidence.

The main stream above the falls.—This section of the river, together with its branches, the Obsidian, Indian, Panther, and Straight Creeks, also Grizzly Lake and Glen Creek, above the falls, were previously barren waters in which eastern brook trout are now abundant.

GIBBON RIVER ABOVE FALLS AND GREBE LAKE.

Rainbow and eastern brook trouts are now abundant in these previously barren waters. Blackspotted trout were planted in Grebe Lake in 1912, but the results are not yet known.

MADISON RIVER AND BRANCHES.

Firehole River, Gibbon River below the Falls, Nez Perce Creek, Little Firehole River, etc.—Native blackspotted trout, whitefish, and grayling are abundant, as are also Lock Leven and brown trouts. Eastern brook trout and rainbow trout are numerous in Gibbon River. Mr. Clark wrote:

> The junction of Yellowstone and Lamar Rivers is noted for fine fishing. If you find the waters high, swift, and roily, you will probably try your flies in vain. Put on a spinner or a little spoon and watch the fish rise to it, almost touch it, and then go away. They are after live bait and wont touch anything else. The grasshoppers are abundant; catch a few, bait your hook carefully, and let it float down with the current. A large trout will rise to it, and if you are not very careful he will steal it from you.

SHOSHONE LAKE AND CREEK; LEWIS LAKE.

Lock Leven and lake trouts are abundant, and eastern brook trout abound in Shoshone Creek. Mr. Clark wrote that the Shoshone and Lewis Lakes region was probably the best fishing in the park:

> These two lakes and their outlet, Lewis River, are full of native trout and have been stocked with Mackinaw and Lock Leven trout, which are increasing in size and number most successfully. These fish will not rise to the surface and take the fly as do the regular native trout, and it is necessary to go down into the water for them. In the lakes you can catch them by trolling, if you can find the particular cove where they happen to be running. However, in spite of the uncertainty of the lake trolling, there is one place where you can troll with assurance of success, and that is in the canal between Shoshone and Lewis Lakes. This is a natural body of water with little or no current and not very wide. In Lewis River just below Lewis Falls, in the deep pools where the eddies are covered with foam, you are sure to find good fishing.

Duck Lake (near Thumb of Yellowstone Lake).—Blackspotted trout are abundant, but landlocked salmon planted in 1908 have not since been observed

MINOR WATERS.

Pelican Creek.—Stocked with blackspotted trout from the Yellowstone Lake hatchery. Mr. Clark says:

> One mile east of Yellowstone River outlet is Pelican Stream which rises in the cold snows of the mountains and empties its waters into the lake. Here you catch quantities of uncontaminated trout, large, beautiful, fat, and gamy, as free from worms as the fresh cold waters they swim in are free from pollution.

Clear Creek, Eleanor Lake, Middle, Crow, and Jones Creeks, and Sylvan Lake.—All of these are stocked with blackspotted trout from the hatchery.

Small lake near Sepulchre Mountain.—Eastern brook trout were planted in 1912, but the results are as yet unknown.

Swan Lake (connects with Glen Creek and upper Gardiner River).—The planted eastern brook trout seem to have left the lake for the small streams, as they have never been found in the lake.

Twin Lakes.—Whitefish were planted in 1899, but have never been heard of since.

Beaver Lake (connects with Obsidian Creek).—Eastern brook trout are plentiful in the lake, but the rainbow trout also planted there have never been heard of.

De Lacy Lake.—The rainbow trout planted in 1895 have not been observed.

Ice Lake (near Gardiner River).—Eastern brook trout planted here have never been reported.

Ice Lake (between Fountain and Excelsior Geysers).—Blackspotted trout planted in 1905 have not been heard of.

Upper Basin Lakes (in Firehole Basin). Black bass planted in 1895 never have been observed.

FISHING RULES AND REGULATIONS.

The following rules and regulations applicable to fishing in the park have been prescribed by the superintendent:

> Fishing with nets, seines, traps, or by the use of drugs or explosives, or in any other way than with hook and line, is prohibited. Fishing for purposes of merchandise or profit is forbidden. Fishing may be prohibited by order of the superintendent of the park in any of the waters of the park, or limited therein to any specified season of the year, until otherwise ordered by the Secretary of the Interior.
>
> All fish less than 8 inches in length should at once be returned to the water with the least damage possible to the fish. Fish that are to be retained must be at once killed by a blow on the back of the head or by thrusting a knife or other sharp instrument into the head. No person shall catch more than 20 fish in one day.

PARASITES OF THE TROUT.

It has long been known that in certain waters of the Yellowstone Park trout are infested with parasitic worms, while in other park waters they were free from this parasite. Yellowstone Lake fish appear to be the most seriously affected, and the fact of this parasitism has been of no little concern to anglers, consumers of fish, and fish culturists in that region.

This parasite is a tapeworm, to which the late Prof. Joseph Leidy, who first described the species, gave the name of *Dibothrium cordiceps*. In the larval stage this worm occurs in cysts among or on the viscera of the trout, free among the viscera, beneath the peritoneal lining of the abdominal cavity, or in the muscular tissue.[a]

It is only the larval or intermediate stage that occurs in the trout, the host of the adult appearing to be an entirely different animal, as is the case with all tapeworms. Briefly, its life cycle seems to be as follows: Starting with the egg in the water, it develops into a ciliated embryo. This passes into the trout, where it becomes established and assumes the form commonly observed. The fish is eaten by the pelican, and in the intestinal tract of this bird the parasite attains its adult and reproductive stage, and its round of life is there completed. The eggs pass from the bird into the water, and a new generation is begun.

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[a] A full discussion of this subject will be found in the following paper: A contribution to the life history of *Dibothrium cordiceps* Leidy, a parasite infesting the trout of Yellowstone Lake. By Edwin Linton. Bulletin U. S. Fish Commission, vol. IX, for 1899, p. 337-358, with plates.

This parasitism of the trout is of much concern to the angler because the fish thus affected are likely to be lazy or inactive. To the consumer such fish are more or less objectionable, not only because they are "wormy," for the worm is a "tapeworm" of proverbial aversion and dread, but because the fish are sometimes deteriorated in quality and flavor and considered unfit to eat. To the fish culturist, whose concern comprises both of the foregoing, there is the fear of spreading the infection to other waters. As the most seriously affected trout are found in the warmer waters, the angler can get some relief by fishing in cool waters.

As an answer to the query of the consumer, it may be said that no known tapeworm for the adult of which man acts as host finds its intermediate host in fishes. Furthermore, as cooking destroys the vitality of the worm, there would be little or no danger from that source, besides which there is probably no edible fish that is not more or less affected with some kind of parasitic worms.

However, it may dispel apprehension to state that similar tapeworms in some places are actually eaten as food and considered delicacies. In Italy a parasite of the European tench and other cyprinid fishes is sold in the markets under the name of *maccaroni piatti* and eaten, usually under the mistaken notion that it is the roe of the fish. The same or a similar parasite is also eaten by many persons in Lyon where it goes by the appropriate and truthful name of *ver blanc* (white worm). It is stated on good authority that in this country a choice portion of another fish not infrequently contains encysted parasitic worms which the consumer, not knowing its nature, selects as a delicate morsel. However, since these facts are not likely to completely remove a deep-seated prejudice or lead to a general demand for tapeworms on the menu of the park hotels, it would be desirable to be rid of these parasites or even to reduce the number.

Several methods, more or less feasible, have been suggested. The most practical and at the same time the most desirable of these is the introduction of other fishes into Yellowstone waters to detract the attention of the native trout from itself as a food; for it is not improbable that the intensity of this parasitic infection of the Yellowstone Lake trout is increased by cannibalism, since there are no other fishes for the large trout to eat. Also, these additional fishes not being subject to infection by this trout-pelican parasite, by affording other fish than trout as food for the pelicans, would reduce the output of tapeworm eggs from that source. The fish best suited to that end is the chub (*Leuciscus lineatus*) and perhaps the silverside minnow (*Leuciscus hydrophlox*), both of which abound in Heart Lake and Witch Creek.

Tapeworms would probably disappear from trout transferred to other waters where there are no pelicans, unless by chance some other fish-eating bird may be or might become a host for the adult.

LIST OF THE FISHES.

As has been indicated, 10 species of fishes are known to be native to the waters of the park, of which only 3 are reputed to be game fishes. However, 6 others, all game fishes, have been introduced and all but two of them have become acclimatized and afford good fishing.

A brief discussion of each kind of native and introduced fish follows, preceded by a key intended as an aid to the angler in the identification of his catch.

The key is arranged on the alternative plan and is to be used in the following manner: Trace the characters of the specimens with what is said under each succeeding letter, until there is a disagreement, or the name of the fish is reached. When a disparity occurs, go to the double of the letter under which it occurs, thence proceed as before until another disagreement or a name is found, and so on. For example, take the brown trout, assuming that it is not recognized; compare it with statement A, with which it agrees; proceed to B, with which it does not agree, having fewer rays in the dorsal fin. Turn to BB, with which it agrees, and by the name in parenthesis it is found to belong to the Salmonidæ or salmon family. Then go to *b*, with which it is found to disagree in having a large mouth and coarse teeth and more scales than stated. Turn, therefore, to *bb*, where an agreement and the subfamily to which it belongs are found. Proceed regularly then to *d*, which is also found to agree. Continue to *e*, with which it does not agree, as it is not profusely blackspotted and has not 130 scales in lengthwise series. Turn to *ee*, with which it agrees. Proceed to *g*, with which it does not agree. Then turn to *gg*, with which it agrees in the number of scales and color description,[a] and the numbered name of the brown trout is reached. The number indicates its place in the annotated list of fishes which follows the key.

If it is desired to ascertain the name of a specimen of fish without an adipose fin, which, of course, is found not to conform to the statement A, turn to AA and proceed as in the foregoing example.

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[a] The color description of each species as given can not always be relied upon to exactly fit a specimen in hand, owing to the great variability in this respect. However, there will always be more or less approach to the general color scheme as stated, which no other species will show.

ARTIFICIAL KEY TO THE FISHES.

A. Adipose or gristly fin on back situated behind a soft, jointed-rayed dorsal fin. Salmonoid fishes.

B. Anterior dorsal fin long and high, with 19 or 20, or more, fully developed rays. Graylings (Thymallidæ).

a. Coloration: Back bluish gray with purplish reflections; sides and gill covers lighter, with purple and silvery reflections, beautifully iridescent; scales with pearly luster; belly pure white; a few V-shaped black spots between head and middle of dorsal fin but none posteriorly; two oblong, bluish black blotches in cleft between opercle and gill membrane rays (branchiostegals), more pronounced in the male; a line on upper border of belly from ventral to pectoral fins, dark and heavy in the male, very faint in the female. Dorsal fin edged with a red or rosy border; four to seven rows of red or rosy roundish spots, ocellated with white between the dorsal rays; dark blotches forming lines between the rows of red spots. Ventral fins with three rose-colored, branching stripes along the rays, darker between. Pectoral and anal fins plain, with dark border..Montana grayling, 1.

BB. Anterior dorsal fin short with not over 15 fully developed rays. Salmon family (Salmonidæ).

b. Mouth small, teeth sparse, fine bristle-like or none; fewer than 100 fully developed scales in a lengthwise series from the upper end of gill opening to base of tail. Whitefish (Coregoninæ).

c. Scales in longitudinal series 78 to 88; coloration, bluish or grayish olivaceous above, silvery on sides, whiter below; sometimes with dusky, or yellowish or brassy tinge; all fins usually tipped with black; tail and adipose fins bluish or olivaceous. No spots; young with parr marks.

Native whitefish, 2.

bb. Mouth large, teeth strong and sharp; scales comparatively small, more than 100 in lengthwise series. Salmons, trouts, and chars (Salmoninæ).

d. Scales in lengthwise series fewer than 200, body always more or less black spotted. (Salmo.)

e. Scales more than 130 in lengthwise series; body profusely black spotted.

f. Scales in lengthwise series about 160 to 170; spots rather large, profusely scattered and irregular, usually none on the belly; red blotches on the lower jaw and membrane between always present. Extremely variable in coloration and form...........Native trout, 3.

ff. Scales in lengthwise series about 135 to 145; profusely black spotted with only slight if any appearance of red on and between lower jaws. Coloration more or less variable but usually bluish or olivaceous above, sides silvery, everywhere profusely spotted, the spots extending on the sides of the belly and on the vertical fins; upper ray of pectoral spotted; spots on tail small, belly nearly plain; both males and females with more or less diffuse red or rosy lateral band and blotches; often much red on cheek and gill cover.

Rainbow trout, 4.

ee. Scales in lengthwise series fewer than 130. Not profusely black spotted; no rosy wash, band, or blotches along the side.

g. Body comparatively slender, more or less silvery, with no ocellated red spots; black spots irregular in shape, the shape determined by the number of scales occupied; sometimes cross, double-cross, or triple-cross shape.

h. Scales in lengthwise series 118 to 130; in oblique cross series from lateral line to upper base of ventral fin 26 to 30. Upper part bluish or greenish olive, sides silvery with a varying number of X-shaped or crescentic black spots; sides of head with roundish black spots; tip of pectoral blackish; anal and tail fins unspotted, varying much in coloration in different waters. Loch Leven trout, 5.

hh. Scales in lengthwise series about 115 fully developed; 21 to 23 in oblique series from lateral line to upper base of ventral. Color very variable but typically greenish olive on back, silvery on sides; belly white; irregular black spots on back and sides; sometimes two rows on base of dorsal fin; none on tail; variable number, but usually three or four roundish black spots on gill cover. Young often with unocellated bright red spots along sides......................Landlocked salmon, 6.

gg. Body comparatively short and deep; scales in lengthwise series about 120, and about 30 in oblique series. Dark colored, olive or brownish, with numerous irregular black or dark brown spots above lateral fin below; usually ocellated red spots along side; orange or yellow margin on upper part of dorsal and anal and outer part of ventral. Light-colored young much resemble young landlocked salmon but distinguished by the red spots having bluish areolas........................Brown trout, 7.

dd. Scales in longitudinal series usually 200 or more. No black spots whatever.

i. Scales in longitudinal series usually 200 or more (180–205); never any ocellated red spots on sides; no rivulations on back, dorsal fin, or tail. Tail always strongly forked. Coloration extremely variable, generally grayish or yellowish gray, profusely covered with round pale spots, sometimes almost white, again deep orange, usually pale yellow; yellowish spots on dorsal and partial dusky cross bars on upper and lower basal half of tail. Young sometimes with faint mottling on back slightly resembling the brook trout.......Lake trout, 8.

ii. Scales in lengthwise series 215 to 230; red spots on sides always ocellated with bluish; back usually yellowish gray and always vermiculated or rivulated with dusky; dorsal and tail with wavy dusky bars and rivulations; pectorals, ventral, and anal reddish with white outer rays margined behind by a narrow black streak. Coloration highly variable with age, locality, and season.................Eastern brook trout, 9.

AA. No adipose fin; one or two dorsal fins.

a′. Dorsal fins more or less continuous, the anterior of spines or simple unjointed rays; the posterior of soft or jointed rays.

b′. Anterior dorsal composed of strong sharp spines. General color, dark green above, sides and belly greenish; an irregular blackish stripe along the side from opercle to middle of base of tail, growing indistinct and disappearing with age; three oblique dark stripes across cheek and gill covers; some dark spots above and below lateral line. Coloration somewhat variable and quickly changeable..................................Black bass, 10.

bb′. Anterior dorsal composed of weak flexible spines or simple rays; small curved hook at edge of gill cover. Coloration olivaceous, everywhere punctulate with dark spots, conspicuous on top of head, four or five dark blotches on back suggesting cross bars; dorsal, pectorals, and tail with wavy streaks and series of spots; anal and ventral white, or sometimes dusky......Blob, 11.

aa′. Dorsal fin single, the fully developed rays all soft and jointed.
  c′. Mouth wholly inferior with thick papillose lips, especially the lower lip.
    d′. Scales in lengthwise series very small, reduced and crowded anteriorly, 90 to 110. Snout long. Coloration dusky brown, sometimes with a broad red flush or irregular stripe..................Longnose sucker, 12.
    dd′. Scales in lengthwise series 70 to 72, not particularly reduced or crowded anteriorly. Snout not long. Coloration blackish above, males with more or less rosy flush or stripe in breeding season..Rosyside sucker, 13.
  cc′. Mouth more or less terminal or oblique, sometimes slightly inferior, but lips never thick or papillose.
    e′. Mouth oblique.
      f′. Anal rays 8; scales in lengthwise series 55 to 63; mouth very oblique, lower jaw somewhat projecting. Coloration blackish, everywhere dark; scales much dotted and with dark edges; often forming lines along the rows of scales. Males without red...............Chub, 14.
      ff′. Anal fin rays 10 to 13, usually 10 or 11; scales about 58, mouth oblique, short, jaws about equal. Coloration greenish silvery; the back dusky; a dark blue or blackish lateral band between two silvery stripes; the lateral band and below bright orange-red in the males, the red usually ceasing at front of anal; a bright silvery or golden crescent on chubs; a golden streak from snout above eye to gill opening. Very pale in alkaline waters.
      Silverside minnow, 15.
    ee′. Mouth subinferior.
      g′. Upper jaw not protractile, the upper lip continuous with the skin of the forehead, muzzle long and projecting, color silvery, darker above; a dusky lateral shade most distinct in young, males largely rosy..Longnose dace, 16.
      gg′. Upper jaw protractile, i. e., the upper lip capable of being drawn out from the snout; muzzle not particularly long. Color usually dark grayish above becoming paler below, a faint lateral band of dark extending through the eye and around snout.
      Dusky dace, 17.

1. Montana Grayling (*Thymallus montanus*).

The Montana grayling originally existed only in tributaries of the Missouri River above Great Falls.

In the park it occurs naturally in Madison and Gallatin Rivers and branches, Fan Creek, Grayling Creek, and the Firehole River below the falls. It is reported as very abundant at the junction of Firehole and Gibbon Rivers. It is said to ascend, in summer, as far as Firehole Falls and to be found in the Gallatin River in the northwestern part of the park.

The Montana grayling is a most graceful and beautiful fish, of shapely proportions and exquisite coloration. The adult averages from 10 to 12 inches in length and from about ½ to 1 pound in weight.

It prefers swift, clear, pure streams, with gravelly or sandy bottom. It is quite gregarious, lying in schools in the deeper pools, in plain sight, and not, like the trout, concealed under bushes and overhanging banks. In search of food, which consists principally of insects and their larvæ, it occasionally extends its range to streams strewn with bowlders and broken rocks.

Unlike the native trout, the grayling will go long distances, if necessary, to find suitable spawning grounds. They spawn in April and May on gravelly shallows. In the north fork of the Madison River, where the water is comparatively warm, coming from the Firehole River in the Yellowstone Park, the grayling spawns a month earlier than in any other waters in Montana.

In point of activity it even excels the native trout, when hooked breaking the water repeatedly in its effort to escape, which the trout seldom does. It takes the artificial fly eagerly, and if missed at the first cast will rise again and again from the depths of the pool, whereas the trout will seldom rise a second time without a rest. It will also take various baits, such as caddis-fly larvæ, grasshoppers, and worms. Among the recommended flies are professor, Lord Baltimore, queen of the water, grizzly king, Henshall, coachman, and various gauze-winged flies, with no. 10 and 12 hooks.

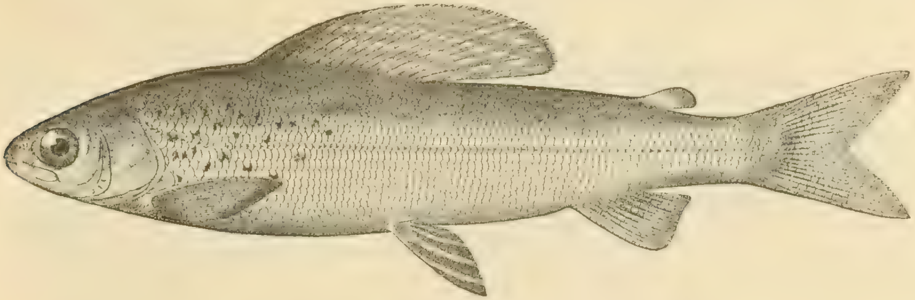

FIG. 1.—Montana grayling.

As a food fish it is even better than the trout. Its flesh is firm and flaky, very white, and of delicate flavor.

2. Native Whitefish; Rocky Mountain Whitefish (*Coregonus williamsoni*).

The Rocky Mountain whitefish occurs in all suitable waters on the west slope of the Rockies from Utah to British Columbia. A scarcely, if at all, distinguishable variety or subspecies bearing the name of *Coregonus williamsoni cismontanus* is found in certain waters of the upper Missouri Basin.

In some localities this fish is miscalled grayling,[a] with which it should not be confused, as it is a very different species; and there seems to be a local Yellowstone River name, the phonetic spelling of which is "sterlet" or "steret."

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[a] Referring to the fishing in the canyon of Sunlight Creek, Clark Fork, Mr. Clark probably made this mistake in writing the following: "You will probably first catch a scaly fish which looks like a long sucker. It is the Montana grayling and there are many down there."

In the park it naturally occurs in the Yellowstone River below the falls as far up as Crevice Gulch, beyond which it is seldom found; also in Madison and Gallatin Rivers below the falls; and has been reported also from the junction of Firehole and Gibbon Rivers.

Young whitefish, 2 to 5 inches long, from Montana, were planted in park waters as follows: In 1889, 2,000 were placed in Twin Lakes and 980 in Yellowstone River above the falls, and 10,000 more were planted in the latter place in 1890. It is considered doubtful if any of these have survived, owing to the number and size of voracious trout in the Yellowstone River and the mineral character and high temperature of Twin Lakes.

This fish prefers clear, cold lakes and streams, where the usual length of adults is about a foot or so, although it is known to have attained a weight of 4 pounds. The *cismontanus* form is essentially a river fish rather than an inhabitant of lakes, and is most abundant in the eddies or deeper places of swift streams. It spawns in late fall or early winter.

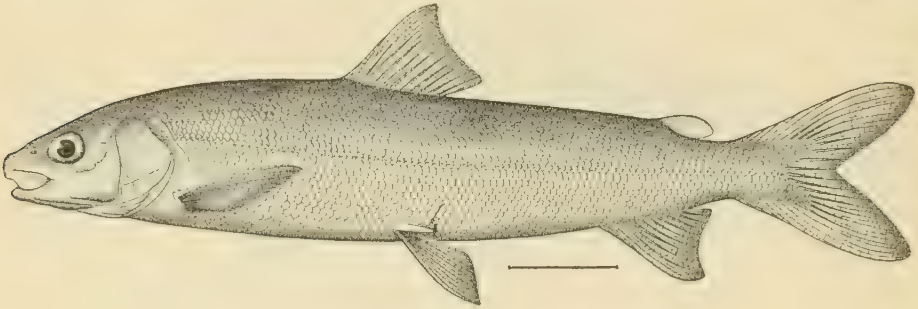

FIG. 2.—Native whitefish; Rocky Mountain whitefish.

It is a slender graceful fish, readily taking the artificial fly like a grayling or trout, as well as natural baits, such as worms and insects, and even fresh meat. However, owing to the smallness of its mouth, the hook should be no larger than no. 10 or 12, and when hooked the fish requires careful "playing" owing to the tenderness of the mouth parts. It is a game fighter. It ranks high as a panfish, for, when in condition, it is of surpassing sweetness and delicacy of flavor.

3. NATIVE TROUT; CUTTHROAT TROUT; BLACKSPOTTED TROUT (*Salmo clarkii*).

(See Frontispiece.)

In its numerous varietal, subspecific, or specific forms the cutthroat or blackspotted trout is of extensive distribution on the Pacific slope. In the park a form previously designated as *Salmo lewisi* is found naturally in both the upper Snake and upper Missouri Waters, having doubtless gained the latter from the Snake River by the way of

Two Ocean Pass, and it is not unlikely that an interchange of individuals still takes place.

Yellowstone Lake and Yellowstone River from its source to many miles beyond the park are inhabited by it. The abundance of trout above the falls is remarkable.

Trout are known to naturally occur in the following park waters:

- Lower Yellowstone River.
  - Sour Creek.
  - Trout Creek.
  - Alum Creek.
  - Antelope Creek.
  - Lamar River.
    - Cold Creek.
    - Willow Creek.
    - Timothy Creek.
    - Miller Creek.
    - Calfee Creek.
    - Cache Creek.
    - Soda Butte, Pebble, and Amphitheatre Creeks.
    - Slough and Buffalo Creeks, Lake Abundance, etc.
  - Hellroaring Creek.
  - Blacktail Deer Creek.
  - Gardiner River.
    - Lava and Lupine Creeks.
- Yellowstone Lake.
  - Beaverdam Creek.
  - Rocky Creek.
  - Trail Creek.
  - Chipmunk Creek.
  - Riddle Lake and Solution Creek.
  - Arnica Creek and Beach Lake.
  - Columbine Creek.
  - Clear Creek.
  - Bear Creek.
  - Pelican Creek.
- Upper Yellowstone River.
  - Atlantic Creek.
  - Jay Creek.
- Upper Yellowstone River—Continued.
  - Bridger Lake and Creek.
  - Falcon Creek.
  - Thoroughfare Creek.
  - Escarpment Creek.
  - Cliff Creek.
  - Lynx Creek.
  - Phlox Creek.
  - Mountain Creek.
  - Badger Creek.
  - Trappers Creek.
- Madison River.
  - Canyon Creek.
  - Cougar Creek.
  - Maple Creek.
  - Gneiss Creek.
- Snake River.
  - Fox Creek.
  - Crooked Creek.
  - Sickle Creek.
  - Pacific Creek.
  - Heart Lake and Heart River.
    - Witch Creek.
    - Beaver Creek.
    - Surprise Creek.
  - Basin Creek.
  - Coulter, Harebell, and Wolverine Creeks.
  - Red Creek.
  - Forest Creek.
  - Falls River.
    - Mountain Ash Creek.
    - Bechler River.

Gibbon River has no trout above the falls. In the Firehole River trout occur naturally below the falls.

In the Gardiner River trout are abundant from the foot of the falls to its junction with the Yellowstone. Trout have not been seen above Osprey Falls.

In Soda Butte Creek trout are numerous until obstructed by falls in the upper part.

Hellroaring Creek is well stocked in the lower part.

In Canyon Creek trout abound below the falls.

In Lupine Creek, notwithstanding the barrier offered by Undine Falls, it is stated on good authority that trout have been taken in Lava Creek above the falls.

In Riddle Lake trout are numerous.

Alum Creek is said to be one of the best trout streams in the park.

Lake Abundance is reported to be full of trout.

In Heart Lake and at the mouth of Witch Creek trout are numerous.

The following are United States fish-cultural records of distribution of young native trout in park waters:

1889, East Fork of Gardiner River above the falls	968
1904, Duck Lake	290,000
1904, Yellowstone Lake	22,000
1906, Ice Pond	47,000
1908, Duck Lake	175,000
1908, Fisheries Creek	225,000
1909, Cub Creek	1,600,000
1909, Fisheries Creek	890,000
1910, Cub Creek	400,000
1911, Fisheries Creek	75,000
1912, Boat House Creek	600,000
1912, Cub Creek	100,000
1912, Natural Bridge Creek	350,000
1912, Second Creek	300,000
1913, Boat House Creek	725,000
1913, Cub Creek	400,000
1913, De Lacy Creek	850,000
1913, Duck Lake	50,000
1913, Grebe Lake	300,000
1913, Hatchery Creek	460,000
1913, Indian Creek	100,000
1913, Number Two Creek	400,000
1913, Soldier Creek	300,000
1914, Transportation Creek	350,000

It appears that the plant of trout made in 1889 was obtained from Howard Creek, Idaho, in September and planted in Lava Creek above the falls which previously contained no trout according to the superintendent of the park. However, it was subsequently ascertained that trout had possible access to this locality from Blacktail Deer Creek, which has no falls and was abundantly supplied with trout.

It has been said that there seem to be two varieties of native trout in the park, the larger ones of the Yellowstone, with bright yellow bellies, and the smaller kind more silvery in appearance and exhibiting much greater activity and game qualities, of which Tower Creek fish are examples. Also trout of Yellowstone Lake seem to differ from those of Heart and Henry Lakes in having more distinct and rather less numerous black spots. However, in this respect very much individual variation is shown.

The size attained by trout in the park waters, as elsewhere, varies much with locality and conditions. Fish of over 4 pounds have been reported.

This trout in some waters is a highly esteemed game fish and can be taken in all sorts of ways—spoon, phantom, natural bait, artificial flies, etc. Mary Trowbridge Townsend writes of it in the Firehole River:

> The father of the Pacific trout, the blackspotted "cutthroat" with the scarlet splotch on his lower jaw, was most in evidence, with long symmetrical body, grad-

uated black spots on his burnished sides. He is a brave, dashing fighter, often leaping salmon-like many times from the water before he can be brought to creel. We found him feeding on the open riffs or rising on the clear surface of some sunlit pool.

Ralph E. Clark wrote (l. c.) that "the dark, silvergray trout of the West seem to favor flies more in harmony with their own coloring" and mentioned the gray hackle, brown hackle, coachman, grizzly king, Seth Green, black gnat, and white moth.

It is an excellent food fish when fresh from cool waters.

4. Rainbow Trout (*Salmo irideus*).

The rainbow trout has its geographical range in the mountain streams of the Coast Range and the west slopes of the Sierra Nevada Mountains, but the natural abode of the rainbow trout of fish-cultural fame is the McCloud River, Cal. In fish books this form is recognized as a subspecies and there bears the name of *Salmo irideus shasta.* It has been successfully introduced into many streams in different parts of the United States where it was not previously found. The following plants have been made in the Yellowstone Park:

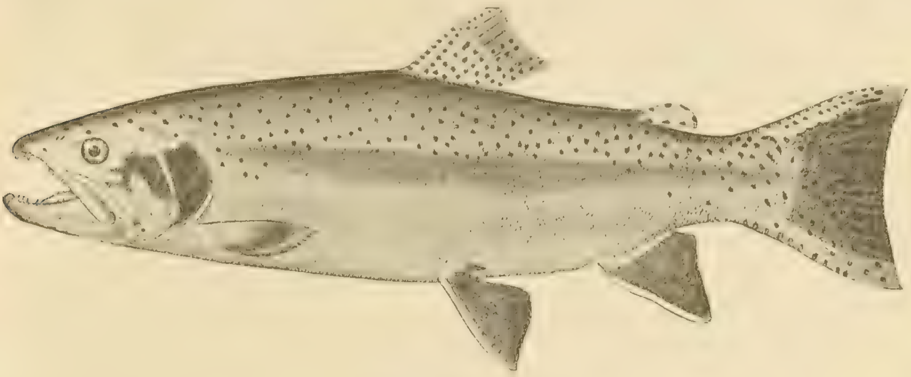

Fig. 4.—Rainbow trout.

1889, Gibbon River (Grebe Lake above Virginia Cascade)	990
1896, De Lacey Lake, near Mammoth Hot Springs	——
1906, Gibbon River	10,000
1908, East Fork of Gardiner River	200
1908, Gardiner River	10,000
1908, Tributaries of Yellowstone Lake	3,700
1909, Gibbon River	7,000
1909, Grebe Lake	8,500
1909, Little Blacktail Creek	3,000
1910, Rock Lake	10,000
1910, Gibbon River	15,000

The size attained by the rainbow trout varies greatly and is dependent upon volume of water, temperature, food supply, etc. Under certain conditions it reaches an extraordinary size, but in the ordinary environment 6-pound or 8-pound fish are to be regarded as large. In general it may be said that the fish does not overrun 2 pounds. Its food is composed largely of insects.

In the McCloud River its spawning season is from February to May, but in the park it appears to spawn somewhat earlier. Many persons who have had experience in angling for rainbow trout say it is one of the best, and some pronounce it the very best, of the trouts. It often dashes from the water to meet the descending fly, and leaps repeatedly and madly when hooked. It has been said that it takes the fly so readily that there is no reason for resorting to other lures. However, its activity and habits, as in the case of most fishes, are modified more or less by its surrounding conditions. The same is true of its food qualities, which are ordinarily very good.

Mary Trowbridge Townsend (l. c.) had the following to say relative to her experience with the rainbow trout in Firehole River:

> The California rainbow trout proved true to his reputation, as absolutely eccentric and uncertain, sometimes greedily taking a fly and again refusing to be tempted by the most brilliant array of a carefully stocked book. During several days fishing we landed some small ones, none weighing over 2 pounds, although they are said to have outstripped the other varieties in rapidity of growth, and tales were told of 4-pounders landed by more favored anglers.

This fish has been reported from the Gibbon River both above and below Virginia Cascades. Regarding this stream, the superintendent's report for 1897 shows that the fish planted above the cascades seemed to have come down over the falls, as but few were found above, while below the stream was well stocked to its junction with the Firehole.

Grebe Lake, Blacktail Deer Creek, Madison, Firehole, and Little Firehole Rivers all contain rainbow trout. Referring to the last-named stream in 1897, the superintendent of the park wrote that several good specimens had been taken near its mouth, for which he could not account, as it seemed impossible for any fish to ascend the lower falls of the Little Firehole.

5. LOCH LEVEN TROUT (*Salmo levenensis*).

This trout originated in Loch Leven, the lake made famous by Scott's poem, "The Lady of the Lake." Typically it was peculiar to this loch, where it seldom if ever attained much over a pound in weight.

The claim has been made that it is merely an ontogenetic development of the common brown trout and that when transferred to other waters its progeny can not always be distinguished from the common brown trout. On the other hand, information derived from persons familiar with Loch Leven indicates that both this trout and the brown trout exist in the same lake and that in that body of water they can always be distinguished at whatever age or condition.

It is not impossible that confusion has arisen by brown trout from that lake having been propagated under the supposition that they were Loch Leven trout. There are parallel instances of such mistaken identity in this country in respect to other species, and so-called Loch Leven trout have been propagated for a long time in this country. In the early years the progeny of Loch Leven eggs could easily be distinguished from brown trout hatched at the same time, especially when they had attained a few inches in length. Recently, however, there is reason to suspect that many of the so-called Loch Leven plants have been brown trout. Be that as it may, trout under each name have been introduced into Yellowstone Park waters and there are records of both having been subsequently taken.

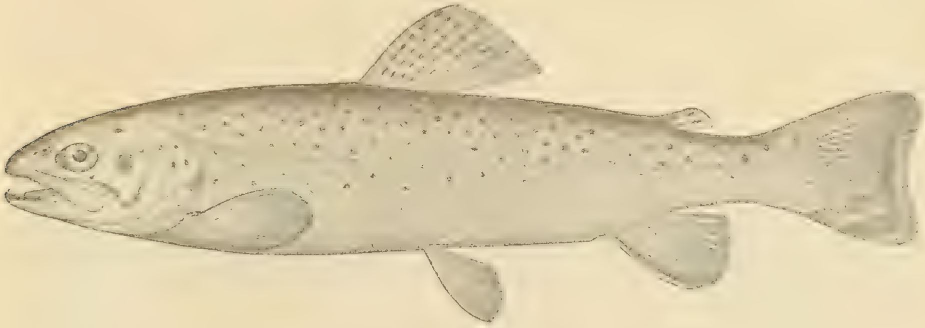

FIG. 5.—Loch Leven trout.

In describing the fishing in the Firehole River, Mary Trowbridge Townsend said:

> One other fish proved a complete surprise. He was of silvery gray color, covered with small black crescents. Some park fishermen called him a Norwegian trout, others the Loch Leven. Any country might be proud to claim him with his harmonious proportions, game fighting qualities, and endurance.

This trout is naturally a lake fish and its peculiarities would suggest a peculiar environment. Whether it will develop and thrive in streams and retain its peculiarities is uncertain. As a game fish it is not excelled by any of its introduced congeners and as a food fish, in its native waters at least, it is unsurpassed in delicacy of flavor. The Loch Leven is primarily an insect feeder and preeminently an artificial-fly fish.

It has been introduced into park waters as follows:

1889, Firehole River, upper courses	995
1890, Lewis Lake	3,350
1890, Shoshone Lake	3,350
1903, Tributaries of Firehole River	9,500

Loch Leven trout have been reported from the following park waters, in some of which they are plentiful: Firehole, both above and below the cascades, Madison, Gibbon, and Gardiner Rivers, Heron Creek, north end of Shoshone Lake, Lewis Lake, "canal" between Shoshone and Lewis Lakes, and upper Snake River waters.

6. LANDLOCKED SALMON (*Salmo sebago*).

In the United States this species originally was known from a few localities in Maine, but has been widely distributed by fish culture. It has become acclimatized in many waters but in others seems not to have become established.

The Sebago salmon requires cool water and plenty of food, which in its natural abode and in those waters where it has thrived best consists chiefly of smelts.

The size attained depends largely upon its food supply and perhaps upon the size of the lake in which it lives. The largest fish of this species have been taken from the largest lake, i. e., Sebago, where two fish of over 35 pounds each have been recorded, and many from 15 to 20 pounds have been taken by anglers.

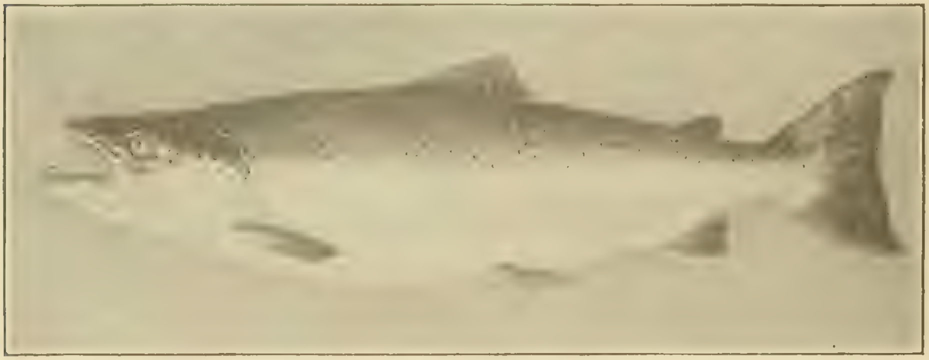

FIG. 6.—Landlocked salmon.

It spawns in the fall, the height of the season in Maine being in the first part of November. Usually the fish ascends inlets or descends outlets for the purpose.

Besides subsisting upon smelts and other kinds of small fishes, it eats quantities of insects at times. It is a highly esteemed game fish, and is accounted by many anglers the prince of game fishes. However, the game qualities are greatly affected by its environment, and the method of fishing has something to do with it.

The usual method of angling for the Sebago salmon is by trolling with lures, which may be a smelt or other small silver fish, artificial minnow or phantom, various spinning contrivances, or artificial fly, and usually these are reinforced by a spoon as a supposed attraction. Whether in lake or stream, this salmon will often take the fly, but the stream salmon are by far the best fly fish. In fact in some localities fly fishing is the only method employed. When taken by this method in a quick-water stream, the Sebago salmon is hard to beat as a game fish.

Among the many taking flies, the silver doctor, grizzly king, Seth Green, Montreal, Jock Scot, brown hackle, and the like are considered by many to be the most effective. General favorites in the way of trolling lures are whitebait and blueback phantoms, although there are others more or less successful.

This fish when properly prepared and cooked is most excellent as food. Baked salmon with sage dressing is highly recommended by those who have tried it.

The only plants of landlocked salmon in the park appear to have been in 1909, when 2,000 were placed in Duck Lake and 7,000 in Yellowstone Lake.

A Department of the Interior bulletin, "General Information Regarding the Yellowstone National Park," issued in 1912, states that the salmon planted in the park apparently did not thrive, as they have never been heard of since they were planted.

7. Brown Trout; Von Behr Trout (*Salmo fario*).

The brown trout is widely distributed in continental Europe and the British Isles, inhabiting lakes as well as streams, but it is the "brook trout" of the European countries. Under favorable conditions it is known to grow to over 20 pounds, but as a true brook trout it seldom registers over one-half or 1 pound in weight.

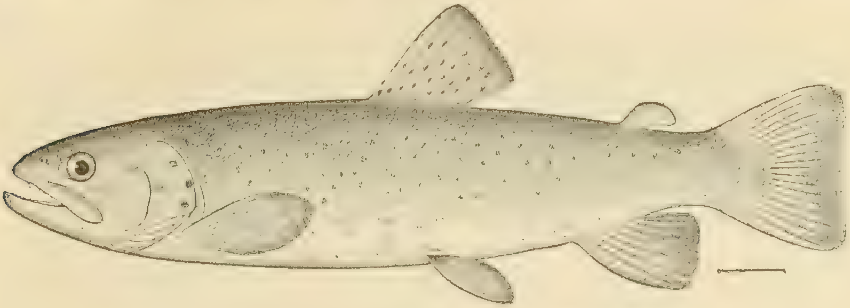

FIG. 7.—Brown trout; Von Behr trout.

The brown trout thrives in clear, cold, rapid streams and at the mouth of streams tributary to lakes, having much the same habits as our eastern brook trout. It is by some regarded highly as a game fish, taking either bait or artificial fly. The best fly fishing is usually toward night. As a game and food fish it is in its prime from May to September. Its flesh is very agreeable in flavor. Spawning begins in October.

In 1890, 9,300 brown trout were planted in Nez Perce Creek. The brown trout has been caught in Nez Perce Creek, Madison, Gibbon, and Firehole Rivers, in the latter locality from its junction to the lower falls, or Keppler Cascade, and in the Little Firehole below Mystic Cascade and in Iron Creek.

Mary Trowbridge Townsend (l. c.) mentioned one from the Firehole River:

> A good 4-pounder, and unusual marking, large yellow spots encircled by black, with great brilliancy of iridescent color. * * * I took afterward several of the same variety, known in the park as the Von Behr trout, and which I have since found to be the same *Salmo fario*, the veritable trout of Izaak Walton.

8. Lake Trout (*Salvelinus namaycush*).

The lake trout, otherwise known as laker, lunge, togue, mackinaw trout, etc., is of wide northern distribution. In British America it ranges from the Atlantic to the Pacific coasts and northward to the Arctic Ocean. In the United States it is found in many of the larger and deeper lakes in New England, New York, and in the Great Lakes Basin, and in a few localities in the Western States, as Montana and Idaho. It occurs also in Alaska. It has also been spread by fish-cultural operations into waters where it did not previously exist.

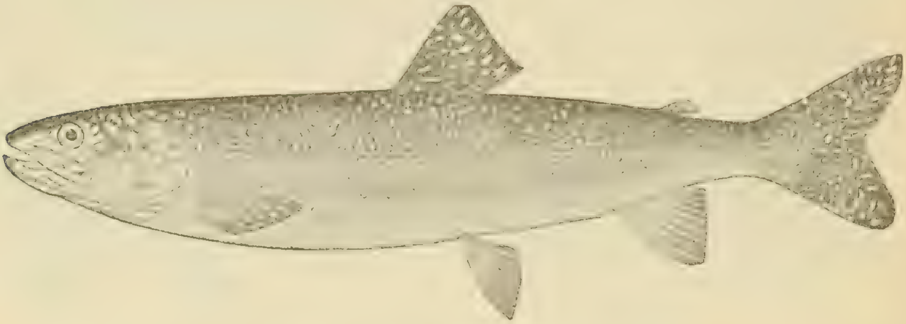

FIG. 8.—Lake trout.

The only plants of this fish in the Yellowstone Park seem to have been 30,012 in Shoshone Lake and 12,013 in Lewis Lake in 1890.

It is, as its name implies, a lake rather than a stream fish. In some waters it attains a very large size. Examples weighing over 100 pounds have been reported from the Great Lakes, and in former years the average weight of the fish in the commercial fisheries of those waters was stated at 20 to 30 pounds. At this time, however, 10 to 15 pounds can be considered large.

Its large size affords its chief attraction as a game fish, for it is not ordinarily a very active fighter, although a powerful antagonist. It is usually caught by deep trolling, but is sometimes found at the surface and is occasionally taken on an artificial fly. Opinions differ regarding its table qualities, and, as with most fishes, much depends upon how it is prepared and cooked. It is a very oily fish and often of an unpleasant, strong, oily flavor. This may be obviated, however, by removing the skin before the fish is cooked. The best method of cooking it is by boiling, serving with mayonnaise dressing or egg sauce.

The lake trout has become established at least in Shoshone Lake, from which in 1914 Dr. H. M. Smith saw brought in by an angler one of 14 pounds and several smaller ones. In his report for 1897 the acting superintendent of the park wrote that he had never heard of any fish being taken from Shoshone or Lewis Lakes, although he had seen fishes apparently of 3 or 4 pounds weight in Shoshone Lake, and the skeleton of a fish that would perhaps have weighed 10 pounds was found on the shore of the same lake. Some soldiers reported having seen schools of trout 2 feet long near the mouth of De Lacey Creek in Shoshone Lake.

These are quite possibly lake trout, although Loch Levens had been planted in the same waters. However, Mr. Clark (l. c.) wrote in 1908 that lake trout were plentiful in Shoshone Lake and Lewis Lake and River, and that they could be caught in the "canal" between Shoshone and Lewis Lakes as fast as one could throw in a trolling spoon, and he remarked that they were large and fat.

9. EASTERN BROOK TROUT; SPECKLED TROUT (*Salvelinus fontinalis*).

The natural western limit of this brook trout in the United States is northeastern Minnesota. It inhabits lakes as well as streams, and varies in size according to locality. It does not flourish in temperature of over 68° F., and about 50° F. is preferable. The largest trout of this species authentically recorded weighed some over 12½ pounds. In some lakes trout of 5 or 6 pounds are not uncommon, but such large fish are seldom found in streams unless the streams are tributary to fairly large lakes. In streams of moderate size trout of 1 or 2 pounds weight are to be considered large, and in most brooks a trout of one-half or three-fourths pound is an exception, at least in recent years. Its spawning season is in fall.

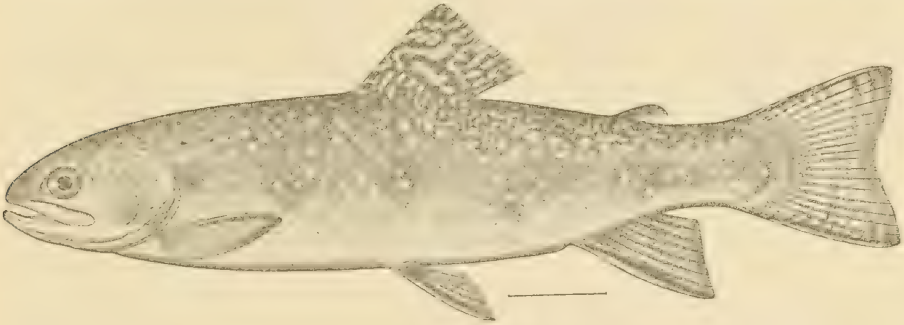

FIG. 9.—Eastern brook trout; speckled trout.

The brook trout is one of the most noted and esteemed of American game fishes, but there must be something besides activity that makes it such a general favorite, as in that respect it is surpassed by several others. One appealing attribute is its beauty of coloration, and another is its delicacy of flavor, which is hardly surpassed by any other fish.

The brook trout may be taken by almost any method known to anglers. In open streams fly fishing is the method par excellence. In streams where overgrowth prevents fly casting, angleworms, grasshoppers, or almost any bait will be taken when the trout is feeding. Everything will be disregarded when it is not feeding. The best flies to use in any body of water must be learned by experience, but the brown hackle is seldom a failure anywhere. Professor, queen of the water, Montreal, coachman, and many others are usually quite successful. Gauze-winged flies will sometimes succeed when others fail.

The best time to fish for this trout is in the morning and early evening. It lurks in eddies and pools and at the foot of rapids, or under overhanging banks, old stumps, or rocks.

The plants of eastern brook trout by the Bureau of Fisheries have been made in park waters as follows:

1889, Gardiner River	4, 975
1890, West Fork of Gardiner River	7, 875
1893, Shoshone Creek	4, 500
1901, Willow and Glen Creeks	10, 000
1902, Glen Creek	9, 000
1902, Willow Creek	18, 000
1902, Indian Creek	11, 000
1903, Tower Creek	15, 000
1905, Gibbon River above Virginia Cascade	17, 000
1905, Willow Creek	27, 000
1906, Willow Creek	45, 000
1907, Indian Creek	34, 000
1907, Willow Creek	63, 800
1908, Indian Creek	27, 000
1908, Swan Lake	9, 000
1908, Willow Creek	28, 000
1909, Willow Creek	20, 000
1910, Glen Creek	5, 000
1910, Indian Creek	15, 000
1910, Willow Creek	20, 000
1911, Lava Creek	5, 000
1913, Blacktail Creek	22, 500

The brook trout now occurs in Obsidian, Indian, Panther, Winter, Straight, Glen, and Willow Creeks; Grizzly Lake; upper Gardiner River, Firehole River above Kepler Cascades and between its junction with the Gibbon and the lower falls; Gibbon and Madison Rivers, Virginia Meadows, streams along the road from Wylie Camp to Apollinaris Spring, Shoshone Creek and Beaver Lake. The report of the superintendent of the park for 1897 calls attention to the fact that brook trout were very numerous in the Firehole River above Kepler Cascades, evidently having been planted there through mistake for Loch Leven trout, none of which had ever been observed. The same report stated that Shoshone Creek was literally alive with brook trout up to 1½ pounds in weight.

10. Largemouth Black Bass (*Micropterus salmoides*).

There were two introductions of black bass in park waters. In 1893 Gibbon River received 250 and in 1896 "lakes in Yellowstone National Park" are indefinitely mentioned as having received 500.

Which of the two kinds of black bass composed the first plant is not known, but the latter plant was composed of the largemouth form. According to the circular of information issued by the Department of the Interior in 1912, there is no indication that its introduction into park waters has been a success, as this fish has not since been reported. In the opinion of the Bureau of Fisheries, no further efforts should be made to establish the black bass in the park. This fish does not harmonize with trouts, and its predatory habits make it an unsafe species to introduce into these waters.

The largemouth black bass is widely distributed in the east, from Canada and the Red River of the North southward to Florida, Texas, and Mexico; it everywhere abounds, especially in bayous and other sluggish waters.

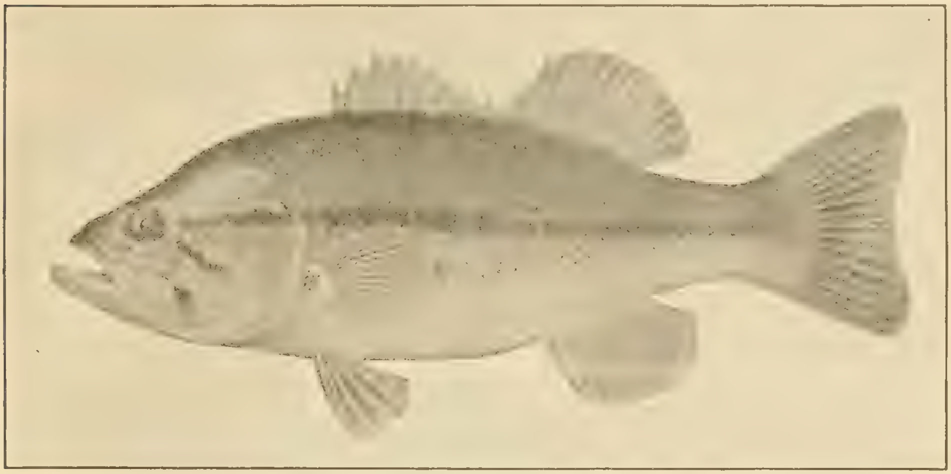

FIG. 10.—Largemouth Black Bass.

In the north the maximum weight attained is about 8 pounds, and the average probably about 3 or 4 pounds, but in the south a much larger size is reached. It is a common market fish in many localities. The game qualities depend upon various factors, but in some parts of its range are of a high order.

11. BLOB (*Cottus punctulatus*).

This little fresh-water sculpin abounds in some of the waters of the park. It is stated to swarm in the grassy-bottom portions of Madison and Gibbon Rivers, also in Canyon Creek, and to be numerous in the Gibbon above the falls. It is also known from the Firehole below the falls.

It is probably justly accused of being destructive to the eggs of other fishes, and appears to be of little use, unless possibly as bait for large trout. It can be taken with a small baited hook.

12. Longnose Sucker (*Catostomus catostomus*).

This sucker is of wide natural distribution in northern waters, its geographical range being from the Pacific to the Atlantic coasts and into the Arctic regions.

It attains a weight of several pounds. Its spawning time is in the spring and early summer, when the males have their anal fin profusely tuberculate and the side of the body with a broad red stripe more or less diffuse on the edges. It is not sought as a game fish but sometimes takes a baited hook and fights fairly well.

When taken from cool water and cooked at once it is a good-flavored panfish, although somewhat bony.

It is abundant in Yellowstone and Gardiner Rivers below the Osprey, Undine, and Rustic Falls, and reaches a length of 18 inches.

13. Rosyside Sucker (*Catostomus ardens*).

This sucker is abundant in the Snake River Basin above Shoshone Falls, where it attains a length of 18 inches or more. It has been reported from Heart Lake and Witch Creek and is said to ascend the latter into very warm water. Like the longnose sucker, it spawns in spring or early summer. It will also take a baited hook, and is edible but not as palatable as the other sucker.

In Heart Lake and Witch Creek the alimentary tract of the sucker is infested by parasitic worms, which, although offensive to the eye, do not render the fish harmful as food. Affected fish, however, are likely to be lean and unpalatable.

14. Chub (*Leuciscus lineatus*).

This chub, known in the books as Utah Lake chub, is one of the most widely distributed of the genus and abounds in the Snake River Basin above Shoshone Falls; also in Yellowstone Lake and other places in the park.

Chubs from cool water are not to be despised in game and food qualities. This species reaches a length of 12 or 15 inches or more and is said to be destructive to the eggs and young of trout. No worms have been found in the alimentary canal of this fish. It spawns in spring and early summer.

Dr. Jordan says: "Chubs ascend Witch Creek until they reach water fairly to be called hot, and the sucker is not far behind," enduring a temperature of 88° F.

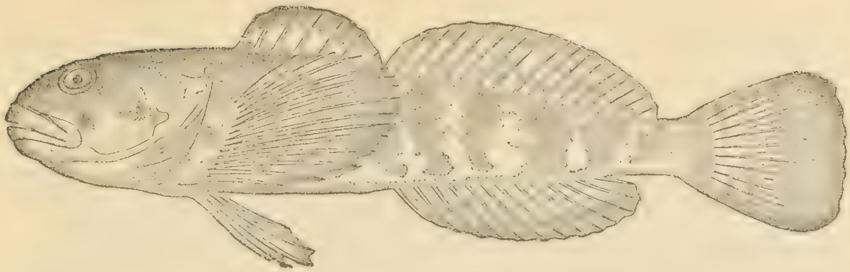

FIG. 11.—Blob.

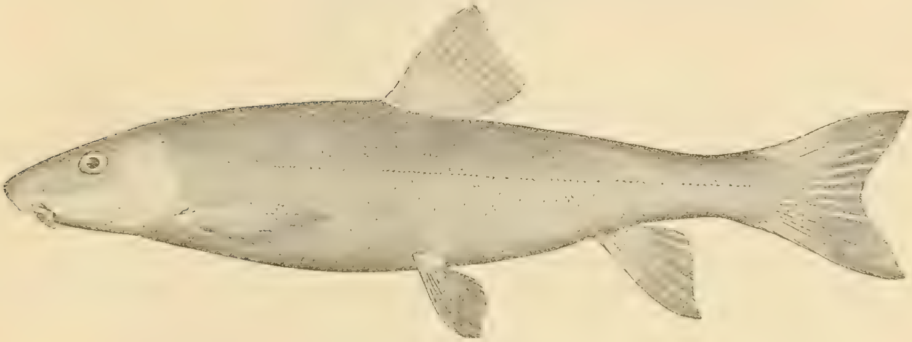

FIG. 12.—Longnose sucker

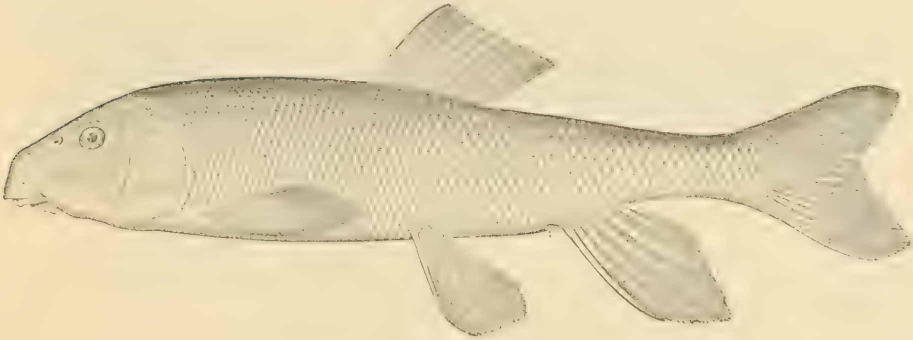

FIG. 13.—Rosyside sucker.

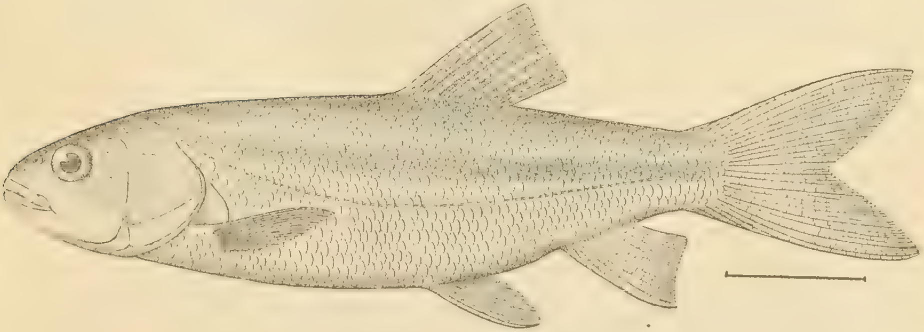

FIG. 14.—Chub.

15. Silverside Minnow (*Leuciscus hydrophlox*).

This little fish is too small to be of much use for other than food or bait for trout, attaining a length of only 3 to 5 inches. It occurs in some of the Snake River sources in the park, particularly Heart Lake and Witch Creek. It spawns in the spring.

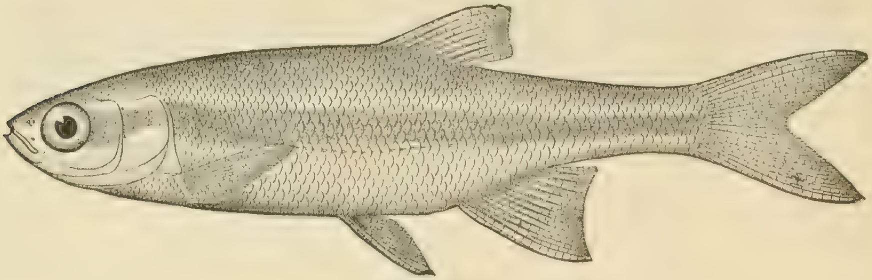

Fig. 15.—Silverside minnow.

16. Longnose Dace (*Rhinichthys dulcis*).

This little fish, attaining a maximum length of only about 5 inches, is food for trout and useful as bait. It is found in Heart Lake and Witch Creek and also in Gardiner River below Osprey, Undine, and Rustic Falls.

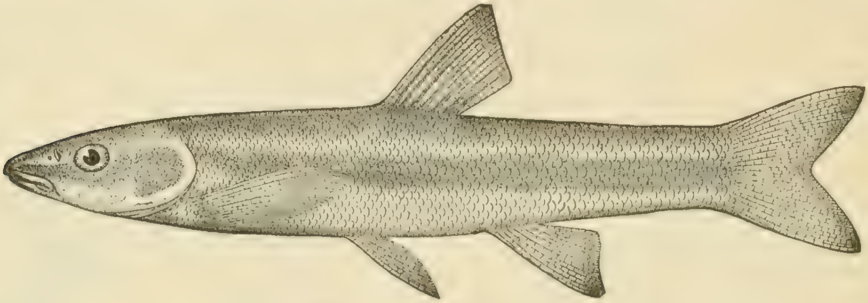

Fig. 16.—Longnose dace.

17. Dusky Dace (*Agosia nubila*).

The little dusky dace, seldom over 3½ inches in length, is extremely abundant and widely distributed in the Columbia River Basin. In the park it has been recorded from Heart Lake and Witch Creek. It is useful as food for larger fishes and as bait for trout.

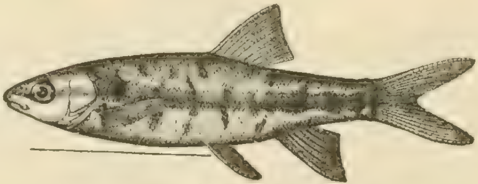

Fig. 17.—Dusky dace.

ALASKA FISHERIES AND FUR INDUSTRIES IN 1914

By WARD T. BOWER, *Agent,* and HENRY D. ALLER, *Assistant*

Appendix IX to the Report of the U. S. Commissioner
of Fisheries for 1914.

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ALASKA FISHERIES AND FUR INDUSTRIES IN 1914.

By WARD T. BOWER, *Agent*, and HENRY D. ALLER, *Assistant*.

INTRODUCTION.

The work of the Bureau of Fisheries in Alaska naturally divides itself into three branches: (*a*) The enforcement of the law and regulations for the protection of the fisheries proper and the operation of hatcheries, (*b*) the administration of the fur-seal fisheries, and (*c*) the minor fur-bearing animal service.

The activities pertaining to the first branch consist of the enforcement of the law and regulations for the protection of the fisheries, together with such investigations of a scientific and economic nature as the limited personnel and funds will permit. In addition a statistical review of the fisheries and methods is prepared each year. The operation of Government hatcheries and the supervision of private hatcheries constitute another phase of this branch of the service.

The fur-seal service embraces (*a*) the administration of the Pribilof Islands Reservation, including the management of the fur-seal and the fox herds and the care of the native inhabitants; (*b*) the enforcement of the law for the protection of the American fur-seal herd elsewhere in Alaska and by extension to the Pacific Coast States; and (*c*) the selling of the fur-seal skins and fox skins taken annually upon the Pribilof Islands.

The minor fur-bearing animal service consists in enforcing the law and regulations for the protection of the various fur-bearing animals in Alaska, which obligation was imposed upon the Department of Commerce by an act of Congress in 1910, with the collection of statistics and other useful information pertaining to these animals and to the fur industry.

FISHERY INDUSTRIES.

As in similar reports for previous years, the Territory of Alaska is here considered in the four coastal geographic sections generally recognized as follows: Southeast Alaska, embracing all that narrow strip of mainland and the numerous adjacent islands from Portland Canal northwestward to and including Yakutat Bay; central Alaska, the region on the Pacific from Yakutat Bay westward, including Prince William Sound, Cook Inlet, and Chignik; western Alaska, the shores of Bering Sea, tributary waters, and the islands in Bering Sea; and arctic Alaska, all that portion of Alaska facing on or tributary to the Arctic Ocean.

Detailed reports and statistical tables dealing with the various fishery industries are presented herewith, and there are also given the important features of certain subjects which were the object of special investigation or inquiry.

STREAMS CLOSED TO COMMERCIAL FISHING.

One of the best methods of meeting a threatened decrease in the supply of salmon or other fishes is by closing streams or waters to commercial fishing, so that the natural spawning grounds will not be disturbed or encroached upon by fishermen. This means of conserving the rich fishery resources of Alaska has been adopted with success in a number of instances and is looked upon with favor by the fishing interests most vitally concerned, as limitations along this line are recognized as being essential at times to safeguard the industry.

In pursuance of this policy there are now closed to commercial fishing by order of the Secretary of Commerce the following waters: Wood and Nushagak Rivers in western Alaska; in central Alaska all streams flowing into Cook Inlet, Eyak Lake, and a limitation on fishing in Eyak River; and in southeast Alaska, Anan Creek and Naha Stream. In addition, fishing limitations by authority of Executive order of the President apply to waters of the following: Afognak Reservation, Aleutian Islands Reservation, and Yes Bay and Stream.

It is expected that in the near future a few additional waters will be set aside by order of the Secretary of Commerce as spawning grounds so as to permit salmon and other fishes to increase.

REMOVAL OF NATURAL OBSTRUCTIONS IN SALMON STREAMS.

There are a number of good streams in Alaska which are so obstructed by falls or other natural barriers that salmon coming in from the sea are often greatly impeded or actually stopped in their search for suitable spawning grounds. A little work has been done to improve these conditions, but in the coming season it is planned to take active steps to open a number of these streams by blasting out resting places or taking other action so that the fish may be able to ascend more easily. Work of this character can be best accomplished in the winter, when the flow of water is lightest.

PATROL BOATS.

In order to enforce the fisheries laws and regulations, a patrol of as adequate proportions as the Bureau's facilities and resources would permit was maintained in those waters of Alaska where there seemed to be the greatest need for such work. This was chiefly in southeast Alaska, where competition is more keen and there is greater activity upon the part of fishermen. Also the restrictions of the weekly close season are applicable in this part of Alaska, and the extensive fishing grounds in the many channels and passages invite and necessitate a careful patrol to insure proper observance of the laws.

The Bureau's steamer *Osprey* (23 tons) was engaged in this and other work of a special nature throughout the season; in addition the power boats *Lovera* (7 tons) and *Baranoff* (17 tons) were chartered for patrol duty during approximately 60 days of the active fishing season. The *Baranoff* was operated chiefly from Wrangell and the *Lovera* was engaged more particularly in the Ketchikan district. The *Santa Rita* (8 tons) was also chartered for a few trips in the vicinity of Juneau, and a launch was hired for a short time, in Prince William Sound. The total cost of patrol work was about $5,000, including salaries, while approximately 10,000 miles were covered by patrol boats. There is much need of additional Government-owned patrol boats to cover the waters of Alaska properly. Under present conditions, some parts of Alaska can not be reached except through transportation courtesies extended on boats owned by the fishing interests. This is entirely wrong in principle, and should be remedied by appropriations which will enable the purchase of at least six patrol vessels; three for southeast, two for central, and one for western Alaska. Seaworthy boats of good size are required to withstand the heavy weather experienced frequently along the Alaska coast. There is too often a disposition upon the part of those who have not observed conditions to feel that a modest launch of 30 or 35 feet in length will be sufficient, at least for southeast Alaska, but to the experienced the need of boats at least 50 feet in length and well powered is recognized. The boats in central Alaska should be at least from 60 to

80 feet in length if efficient service is to be rendered. The cost of the six boats herein suggested will be at least $90,000, and this is only for most urgent requirements. If the Alaska fisheries patrol work is to be put on the efficient basis that obtains in British Columbia, for example, several additional vessels are necessary.

VIOLATIONS OF LAWS AND REGULATIONS.

One of the most important duties placed by Congress upon the Bureau in its work in Alaska is the enforcement of the fisheries laws and regulations. It may be said to the credit of the fisheries interests that careful observance of all requirements is the general rule, but at times there have occurred violations of a more or less serious nature, usually due to the acts of irresponsible employees. In the cases which have been handled this season, the Bureau has had the very helpful cooperation of the United States attorneys and marshals.

In the course of the fisheries patrol carried on last summer in the Juneau region, it was found that quite a number of the fish traps inspected were operated in a status constituting a violation of the weekly closing feature of the law. These traps were so constructed as to make it impossible to comply fully with the requirement to lift or lowering 25 feet of the heart next to the pot, so as to permit the free and unobstructed passage of salmon and other fishes. In some instances traps were found to be taking fish, although supposed to be closed. Evidence obtained by agents of the Bureau was laid before the United States attorney and in the latter part of August the grand jury at Juneau returned 13 indictments involving 57 counts against 7 companies. These cases were tried at Juneau in the fall of 1914, with the following results: Taku Canning & Cold Storage Co., 1 indictment for 4 counts, resulting in a verdict of guilty and a fine of $400; Thlinket Packing Co., 3 indictments for 15 counts, the result being guilty; Tee Harbor Packing Co., 1 indictment involving 2 counts, guilty on 1 count, not guilty on the other; Glacier Fisheries Co., 2 indictments involving 7 counts, guilty on all counts; Pacific American Fisheries, 2 indictments involving 20 counts, verdict not guilty; Astoria & Puget Sound Canning Co., 2 indictments for 6 counts, verdict not guilty; and Alaska Pacific Fisheries, 1 indictment for 3 counts, verdict guilty.

A report was received at Juneau on June 23 that a fisherman by the name of Carlin had violated the fisheries law by fishing at Taku between 6 p. m. Saturday, June 6, and 6 a. m. Monday, June 8. An investigation developed the fact that Carlin had been using his gill net illegally. He appeared in the United States commissioner's court at Juneau, where, owing to extenuating circumstances, a fine of but $10 and costs was imposed, with a warning that a second offense would not be dealt with so leniently.

At 6.15 p. m. Sunday, June 28, trap No. 2 of the Irving Packing Co. was found to be fishing. The watchman admitted that it was fishing and stated that he was under orders to keep it open. The Bureau's agent returned the next day at 6.08 a. m. and again found the trap fishing. A complaint was filed before the United States commissioner at Craig against the manager of the company, G. C. Chapin, and the watchman, W. H. Moore. A hearing was held at Karheen on the 30th, with the result that the watchman was discharged but placed under bond as a Government witness. Mr. Chapin was placed under $300 cash bail.

An agent of the Bureau who arrived at the San Lorenzo Island trolling camp on June 28, 1914, found John Cline, a German, fishing in violation of the alien fishing act of June 14, 1906. He was taken before the United States commissioner at Craig, where he pleaded guilty and was fined $5.

A complaint was made before the United States commissioner at Petersburg, charging Billey Grant and Seth Williams with having fished at Point Barrie Creek on the morning of July 20 in violation of the weekly closing law. The case was tried August 1, the defendants were found guilty, and were fined $50 each.

At 5.10 a. m. on the morning of July 27, a trap of the Alaska Packers Association was found fishing in violation of the weekly closing requirement. The case was taken before the United States commissioner at Ketchikan. The defense was based on the claim that the trap had been closed for a period of 36 hours and that the offense was due to differences in time. After a protracted hearing the commissioner dismissed the case, advising the defendants to keep better time.

At 4 a. m. on the morning of August 3, trap No. 1 of the Hawk Fish Co. was found operating in violation of the closing law. A. E. L. Bell, superintendent of the company, and Andrew Rosnes, trap watchman, appeared at a hearing held at Juneau on August 4, a fine of $100 and costs was imposed on the company.

At the special August, 1914, term of court held at Juneau the grand jury indicted the Pure Food Fish Co., Patrick Hamilton, Nick Bez, and John Pecar, for having set a purse seine within 100 yards outside the mouth of Karta River, a red-salmon stream, the mouth of the stream at that point being less than 500 feet in width. The case was brought to trial in the district court at Ketchikan in December. During the course of the trial the court dismissed the charge against the Pure Food Fish Co. because of insufficient evidence. The three remaining defendants were found guilty and fined $25 each. In charging the jury, the court defined the mouth of a stream emptying into a bay as being where the stream joins the water of the bay at low tide.

In July complaints were filed at Cordova against the Northwestern Fisheries Co. for (*a*) canning fish after they had been killed 48 hours, (*b*) seining within 100 yards of the mouth of a red-salmon stream less than 500 feet in width, (*c*) seining more than one-third the way across an estuary, (*d*) seining less than 100 yards from a net already set, and (*e*) waste of fish. The company pleaded guilty to each of the five charges, and fines and costs amounting to $100 for each charge were imposed.

This season 16 indictments were returned and filed in the district court at Valdez against the Northwestern Fisheries Co., Libby, McNeill & Libby, the Alaska Packers Association, and the Fidalgo Island Packing Co., charging them with the wanton waste of salmon and other food fishes during the year in connection with the operation of their canneries at Port Graham, Kenai, and Kasilof. The companies were cited to appear and answer the indictments in April, 1915.

On July 7 Henry Vestad and Charles Peterson were found fishing in Wood River, in violation of the Department's order of December 19, 1907, closing the stream to commercial fishing. A complaint was filed before the local United States commissioner and each was fined $1, they also paid costs amounting to $36.80.

At the request of the Deputy Commissioner of Fisheries the case against the Alaska Pacific Fisheries and A. Carlson, owner and watchman, respectively, of a trap charged to have been fishing illegally at Yes Bay on Sunday, August 4, 1912, was dismissed.

In some parts of interior Alaska but little or no thought is given the general fisheries laws and regulations for the Territory which are equally as applicable there as along the coast. Prospectors, especially, are quite apt to set nets entirely across small streams for a few days in order to catch grayling. In the fall just before the freeze-up this is a common occurrence; the fish may then be frozen and kept all winter if necessary. Though this is not a particularly injurious practice, it is nevertheless contrary to law to thus set nets entirely across streams or other waters. Sometimes nets or fish wheels are placed near the mouth of a small stream to catch salmon. This is more often done by Indians. Such violations are due almost entirely to ignorance of the law, and those concerned willingly comply with the requirements when brought to their attention.

TRAP VERSUS OTHER FORMS OF FISHING GEAR.

There has been considerable unfavorable criticism in Alaska regarding the use of traps, for the alleged reason that they are depleting the salmon fisheries. This criticism appears very largely to be due to misapprehension, for, as a matter of fact, when traps are properly regulated and the operators observe the law with respect to closing them for a period of 36 hours each week, there is little danger of their becoming a serious menace. It is even deemed unnecessary that resort should be had to this weekly close period for some portions of Alaska.

Traps have one desirable advantage over purse seines or gill nets. Fish taken in traps remain alive until they are removed, they are usually delivered at the canneries within a few hours afterwards; whereas, fish taken in purse seines are removed from the water immediately upon capture, and it not infrequently happens that two or three days elapse before the fish reach the canneries. Fish taken in gill nets are also frequently held for some time before being delivered at the canneries.

Purse seines and gill nets may also be surreptitiously operated close to mouths of streams where the salmon assemble preparatory to ascending for spawning purposes. It is obvious that since traps are a fixed form of apparatus they can not be thus used. From this point of view purse seines and gill nets threaten the future supply of salmon in Alaska more than any other form of fishing gear. It is surprising to note that the average annual catch of salmon by purse seines during the last 10 years has been about 75,000 per seine, as against an average of about 90,000 per trap. Of course, some traps take several hundred thousand fish in a season, extending from the latter part of June until the middle of September. When one notes that most of the channels in which traps are located in Alaska are several miles in width and that trap leads average less than 1,500 feet in length, it can readily be seen that the catch by this method is not apt to be, by any means, as great a proportion of the fish present as has been claimed by those opposed to traps. They are always located near the shore, and it is true that in some cases salmon seem to follow paths close inshore; but ordinarily they may be seen across the entire channels through which they come in from the sea, thus refuting the erroneous popular impression that traps are so serious a menace that their further use should be prohibited by legislation. The trap is a modern fishing appliance and is used in many parts of the country. It should not be legislated out of existence any more than seines or gill nets, but like these its use must be regulated properly. Traps are fixed and are thus easier for the inspectors to keep track of than seines, which are constantly on the move.

OBSERVATIONS IN THE WOOD AND NUSHAGAK REGIONS.

In the spring of 1914 one of the Bureau's agents was sent to Nushagak, and all advance arrangements were perfected, as heretofore, for conducting an investigation and taking a census of the salmon run in Wood River. It was contemplated that this work would be conducted along the same general line followed each season since its inception in 1908. Unfortunately, however, in the season of 1914, the passage of the regular appropriation bill was so delayed that it was impossible to carry the work through. A continuance of the work is contemplated for at least two or three seasons longer; it is a matter of regret that there should have been a hiatus for the year 1914 in the series of observations, which it is hoped will be, eventually, of great value in regulating the salmon fishery. In brief, the chief feature of this work is to ascertain the number of breeding salmon required to reach the spawning grounds, each season, in order to maintain a constant supply of salmon in the region under consideration. If the factor of escape of breeding salmon can be established, it follows that all fish over and above this requirement can be used commercially without detriment to the future of the industry. The importance of determining these facts is readily apparent.

At the beginning of the season the markers designating the mouths of Wood and Nushagak Rivers were reestablished, thus indicating to fishermen the waters of these streams closed to commercial fishing by the Department's order of December 17, 1907. A patrol was maintained again this season to see that this order was observed. Two fishermen were apprehended within the prohibited waters and were fined.

ALEUTIAN ISLANDS RESERVATION.

By the provisions of Executive order of March 3, 1913, the Aleutian Islands Reservation, defined to include all islands of the Aleutian Chain, the Sannak Islands, and Unimak Island, was reserved and set apart for the conservation of native birds, reindeer, and fur-bearing animals, and for the development of the fisheries. Jurisdiction over the wild birds and game and the propagation of reindeer and fur-bearing animals was placed with the Department of Agriculture, while the fisheries, seals, sea otter, cetaceans, and other aquatic species were placed under the jurisdiction of the Department of Commerce.

In conformance with the authority conferred by this order joint regulations for the administration of the reservation were promulgated February 28, 1914, by the Secretary of Commerce and the Secretary of Agriculture as follows:

1. In compliance with existing laws and to carry out the objects of the Executive order establishing the reservation, all matters relating to wild birds and game and the propagation of reindeer and fur-bearing animals will be under the immediate jurisdiction of the Department of Agriculture; all matters pertaining specifically to the fisheries and all aquatic life, and to the killing of fur-bearing animals, will be under the immediate jurisdiction of the Department of Commerce; and all matters other than those specifically mentioned above will be under the joint jurisdiction of the Departments of Agriculture and Commerce.

2. Persons residing within the limits of the reservation on March 3, 1913, will be permitted to continue to so reside, and to carry on any lawful business not interfering with the purposes of the reservation.

3. Residents of the reservation desiring to engage in commercial fishing, or the hunting, trapping, or propagation of fur-bearing animals or game animals, must first secure a permit to do so.

4. Anyone desiring to enter the reservation for the purpose of fishing, hunting, trapping, or propagating fur-bearing animals or game animals, or engaging in commercial fishing, salmon canning, salmon salting, or otherwise curing or utilizing fish or other aquatic products, or for the purpose of engaging in any lawful business, must first obtain a permit to do so.

5. Whenever, in the propagation of fur-bearing animals, it shall be found to be necessary to kill such of these animals as interfere with the work of the Department of Agriculture in this behalf, they may be killed under the supervision of said department, and no permit will be required therefor.

6. *Fishery permits.*—Application for permission to engage in fishing or fishery operations should give full information on the following points: Name and permanent address of the person or company desiring the permit; character of business proposed, whether fishing, canning, salting, or otherwise curing fish or other aquatic products; character and extent of proposed plant and its location; method and extent of the fishing proposed, place or places where fishing is to be carried on, and when active operations are to begin.

7. *Trapping and hunting permits.*—Applications for permission to engage in trapping, hunting, or propagating fur-bearing animals or game animals should give the name of the person desiring the permit and the island or islands on which it is proposed to operate. At present no permits will be issued for trapping or hunting fur-bearing animals except to natives of the reservation.

8. *Permits to ship live foxes from the reservation.*—For the present no permits will be issued for capture and shipment of live foxes from the reservation, except domestic stock from established fox farms.

9. Permits to enter the reservation for the purpose of engaging in any business will be granted only when the department concerned is convinced that by so doing the objects for which the reservation was established will not be endangered thereby.

10. *Collecting permits.*—Permits to enter the reservation for the purpose of collecting birds, mammals, or other natural-history specimens for scientific purposes will be granted only to properly accredited representatives of the United States Government or agents of public museums.

11. *Reindeer and caribou.*—The killing of reindeer and caribou on any of the islands of the reservation is hereby prohibited except under special permit.

Several permits were granted during the year to individuals who were to engage in commercial fishery operations within the reservation. With the exception of one permit, it was provided that all work in connection with the taking of fish and their subsequent preparation for market should be performed by Aleuts or Indians residing within the reservation. This requirement has been made with a view to furnishing employment to the natives, whose ordinary means of gaining a livelihood are very limited. The islands of the Aleutian Chain are not regarded as favorable for the location of salmon canneries, for the streams are all comparatively small and not sufficiently productive to provide more than enough fish for salting operations as a food supply for the natives.

AFOGNAK RESERVATION.

FISHING REGULATIONS.

The Afognak Forest and Fish Culture Reserve, now a part of the Chugach National Forest, was created by presidential proclamation promulgated December 24, 1892. The proclamation provided:

> There is hereby reserved from occupation and sale, and set apart as a public reservation, including use for fish-culture stations, said Afognak Island, Alaska, and its adjacent bays and rocks and territorial waters, including among others the Sea Lion Rocks, and Sea Otter Island: *Provided*, That this proclamation shall not be so construed as to deprive any bona fide inhabitant of said island of any valid right he may possess under the treaty for the cession of the Russian possessions in North America to the United States, concluded at Washington, on the thirtieth day of March, eighteen hundred and sixty-seven.
>
> Warning is hereby expressly given to all persons not to enter upon, or to occupy, the tract or tracts of land or waters reserved by this proclamation, or to fish in, or use any of the waters herein described or mentioned.

Regulations governing the reserved waters defined by the proclamation were issued March 21, 1912, by the Secretary of Commerce, as follows:

> 1. No person or persons other than the natives of Afognak Island now resident thereon will be permitted to fish in the reserved waters.
> 2. Licenses for fishing will be granted to the said natives upon application to the Secretary of Commerce [and Labor] or such representative of the Department of Commerce [and Labor] as may from time to time be designated by the Secretary.
> 3. The kinds and amounts of apparatus to be used, the places where and the manner in which it may be operated, and the time when it may be employed, will be determined by the Secretary of Commerce [and Labor] and will be subject to changes or modifications from time to time at his discretion.

These regulations have been supplemented by order of February 6, 1913, extending to native residents of the near-by Spruce, Whale, Dry and Raspberry Islands the same privileges in Afognak waters accorded natives of Afognak Island; also extending the same fishing rights to white men married to native women which were previously granted only to natives.

The affairs of the Afognak Reservation in respect to fishing operations were under the immediate supervision of Mr. E. M. Ball, inspector, Alaska Service. There were certain additional regulations issued by Mr. Ball to cover local conditions in administering fishing operations within the reservation. About the 1st of July he was called to other duty on the Pribilof Islands. After Mr. Ball's departure, and during the remainder of the year matters of the reservation regarding fishing and enforcement of the laws and regulations were looked after by Mr. C. F. Townsend, warden, Alaska Service.

CATCH OF SALMON.

There were 73 licenses issued for fishing in the waters of Afognak Reservation in the season of 1914. Operations were conducted in 11 different localities, to which the crews of fishermen, numbering from four to seven men each, moved from time to time in accordance with their impression as to the grounds most promising for a large catch.

The run of sockeyes appeared in May, and, as was the case last year, the wash of volcanic ash from the Katmai eruption of 1912 still caused the streams to be very turbid following periods of rain, which undoubtedly had the effect of keeping some salmon away from these streams. Conditions, however, with regard to the quantity of volcanic ash are improving, and before long this annoyance will have disappeared. The fact that the catch of salmon in Afognak waters this year was practically double that of last year is evidence of the improvement in these conditions.

The first fishing in this reservation occurred May 30, at Kaluda, and the last fishing took place at Little Afognak on September 6. The best grounds for sockeyes were at Malina, Eagle Harbor, and Paramanof, while the best catches of humpbacks occurred at Kaluda and Malina. The only take of cohos worth mentioning was at Little Afognak, and, as was the case last year, practically no dog salmon were taken. The catch of sockeyes was 214,450; humpbacks, 113,060; and cohos, 3,420; or a total of 330,930 salmon. Malina was the most productive, having nearly one-third of the entire catch. Of the total, 91 per cent were taken by haul seines and the balance by gill nets.

The catch of salmon in the commercial fisheries of Afognak waters for 1914 is shown, by locality and species, in the following table:

CATCH OF SALMON IN THE AFOGNAK RESERVATION; SEASON OF 1914.

Localities.	Sockeyes.	Humpbacks.	Cohos.	Total.
Danger Bay	37	2,423	....	2,460
Eagle Harbor	45,159	....	....	45,159
Elia Bay	1,714	62	....	1,776
English Bay	2,443	2,167	....	4,610
Kaluda	17,222	39,470	....	56,692
Kizhuyak	2,013	8,275	111	10,399
Little Afognak	8,057	3,468	2,956	14,481
Malina	80,196	21,939	4	102,139
Paramanof	31,460	77	....	31,537
Seal Bay	23,124	35,179	349	58,652
Shuyak Island	3,025	....	....	3,025
Total	214,450	113,060	3,420	330,930

Comparing the above figures with those of 1913, it is found that there was a gain in 1914 of about 113,000 sockeyes and 65,000 humpbacks, while cohos fell off about 700.

A detailed statement of the methods of capture of each species and the beginning and end of the fishing season in each locality is shown in the table following:

Fishing Season and Apparatus, Afognak Reservation, 1914.

Localities.	Sockeyes.		Humpbacks.		Cohos.		Fishing season—	
	Gilled.	Seined.	Gilled.	Seined.	Gilled.	Seined.	Began.	Ended.
Danger Bay	....	37	....	2,423	....	....	Aug. 14	Aug. 14
Eagle Harbor	12,600	32,559	....	....	....	....	June 2	Aug. 18
Elia Bay	....	1,714	....	62	....	....	July 24	July 26
English Bay	2,398	45	18	2,149	....	....	Aug. 7	Aug. 16
Kaluda	7,633	9,589	1,128	38,342	....	....	May 30	Aug. 15
Kizhuyak	1,447	566	1,130	7,145	....	111	June 11	Aug. 22
Little Afognak	681	7,376	15	3,453	557	2,399	June 6	Sept. 6
Malina	....	80,196	....	21,939	....	4	May 30	Aug. 22
Paramanof	....	31,460	....	77	....	....	June 1	July 30
Seal Bay	1,000	22,124	....	35,179	....	349	June 10	Aug. 12
Shuyak Island	337	2,688	....	....	....	....	June 8	July 4
Total	26,096	188,354	2,291	110,769	557	2,863		

At the prevailing rates paid for salmon, the Afognak catch was worth to the fishermen approximately $8,730, or $4,575 more than the reported value of the 1913 catch. Most of the salmon taken commercially from Afognak waters were sold to the Kadiak Fisheries Co., at Kodiak. One buyer, John J. Folstad, attempted to take Afognak salmon to the cannery of the Fidalgo Island Packing Co. at Port Graham, but on account of the distance the venture was not deemed profitable.

HATCHERIES.

EXTENT OF OPERATIONS.

During the season of 1914 seven salmon hatcheries were operated in Alaska, of which two were Government stations and five were controlled by private companies. The two Federal stations are located at Yes Bay and on Afognak Island. In connection with the Afognak hatchery there also was operated a small field station for the collection of eggs at Uganik, on Kodiak Island. Of the private hatcheries, the Alaska Packers Association has one on Naha Stream and another on Karluk River; the Northwestern Fisheries Co. has establishments at Quadra and at Hetta Lakes; and the North Pacific Trading & Packing Co. and the North Alaska Salmon Co. operate jointly a hatchery at Klawak.

The Fortmann hatchery of the Alaska Packers Association is the largest, with a normal capacity of 110,000,000 sockeye salmon eggs. Each of the two principal Government stations are capable of handling about 72,000,000 eggs, while the field station at Uganik has a capacity of 3,000,000 eggs. The Karluk hatchery can accommodate comfortably 48,000,000; Quadra, 18,000,000; Hetta, 12,000,000; and

Klawak, 10,000,000. This is the normal capacity of these stations, but if necessary it can be increased very materially by putting a larger number of eggs in each basket. A hatching basket of ordinary size holds about 60,000 sockeye salmon eggs, but if urgently required at least 10,000 more eggs may be put in a basket. Of course, if the baskets are crowded it is much more difficult to give the eggs proper attention. The total annual capacity of the hatcheries in Alaska is approximately 350,000,000 salmon eggs. The completion of the Government hatchery at Afognak in 1908 marked the last change in the number of permanent stations operated in Alaska.

A collection of 134,425,160 sockeye salmon eggs was made in the season of 1913, from which plants aggregating 119,668,680 were made, and in addition there was a shipment of 2,000,000 eggs to Oregon. This shows a decline from the previous season, when 150,970,355 sockeye salmon fry were liberated. The take of sockeye eggs in the season of 1914 was 133,984,500, or approximately the same as that of 1913. In 1914 collections of humpback eggs aggregated 19,108,000 as against 19,180,000 in 1913.

OPERATIONS OF ALASKA HATCHERIES IN 1914.

Stations.	Red or sockeye salmon eggs taken in 1913.	Red or sockeye salmon liberated 1913–14.	Red or sockeye salmon eggs taken in 1914.
Yes Bay	49,050,000	43,401,400	[a] 41,300,000
Afognak	10,989,000	7,761,700	[b] 7,390,000
Eagle Lake	2,180,000	[c] 2,180,000	....
Uganik	1,970,000	[c] 1,970,000	(*d*)
Fortmann (Naha)	9,480,000	8,700,000	22,500,000
Karluk	34,629,160	31,546,080	[e] 30,240,000
Quadra	18.400,000	17,654,000	21,300,000
Hetta	4,082,000	3,590.500	7,438,500
Klawak	3,645,000	3,465,000	3,816,000
Total	134,425,160	119,668,680	133,984,500

[a] Also 2,600,000 humpback eggs collected at Mink Creek.
[b] A collection of 6,574,600 humpback eggs also made.
[c] Eggs were planted before hatching.
[d] A collection of 2,534,000 humpback eggs was made.
[e] A collection of 7,400,000 humpback eggs made for Afognak.

NOTE.—Of the Yes Bay collections, 2,000,000 sockeye eggs were shipped in the fall of 1913 to the Oregon Fish Commission, and in the fall of 1914 a shipment of 3,000,000 sockeye eggs was made to the same place.

HATCHERY REBATES.

Pursuant to the provisions of law, operators of private salmon hatcheries in Alaska are allowed a credit upon the Federal fishery tax at the rate of 40 cents for every thousand red or king salmon fry liberated. This amount is the tax equivalent on 10 cases of canned salmon. The purpose of this rebate is to give a just and equitable return to the operators of private hatcheries, as their output of young salmon is a benefit to the fishing interests in general. The rate of 40 cents per thousand is based upon calculations showing that year in and year out this is the average cost of producing a thousand vigorous salmon fry. In recent years, the rebating system has evoked considerable criticism, and it is anticipated that before long Congress will provide for the operation of all hatcheries in Alaska by the Federal Government. This plan will involve paying, at fair valuation, for the private hatcheries operated under the rebating system. The owners of the present private hatcheries are quite in accord with this suggested change.

The operators of private salmon hatcheries in Alaska are required by law to make affidavit as to the number of fry released for each year ending June 30. In accordance with these returns, rebate certificates for the fiscal year ended June 30, 1914, are allowable, as shown by the table which follows:

REBATES CREDITED TO PRIVATE SALMON HATCHERIES DURING THE FISCAL YEAR ENDED JUNE 30, 1914.[a]

Owners.	Location.	Red salmon fry liberated.	Rebate due.
Alaska Packers Association	Naha Stream	8,700,000	$3,480
Do	Karluk River	31,546,080	12,618
Northwestern Fisheries Co	Quadra Lake	17,054,000	6,821
Do	Hetta Lake	3,590,500	1,436
North Pacific Trading & Packing Co., and North Alaska Salmon Co	Klawak Lake	3,465,000	1,386
Total		64,355,580	25,741

[a] In the case of the hatcheries where the seasonal distribution of fry is not completed before July 1, the remaining fry are shown in the subsequent fiscal year's report.

HATCHERY INSPECTION

All private salmon hatcheries in Alaska are inspected at various times each year by agents of the Bureau to determine whether they are operated in a manner which merits the Department's approval. It seems proper to note here that all five of the private hatcheries operated in the year 1914 were well conducted. The only exception to this statement is that in one or two instances there might with propriety have been better facilities for rearing and feeding the young salmon. A feature of the hatchery inspection consists of checking up the records and taking other necessary steps to determine the accuracy of returns regarding the output.

YES BAY.

In the fall of 1913, at the Yes Bay station, 49,050,000 sockeye-salmon eggs were taken, and of these 2,000,000 were shipped to the Oregon Fish Commission and from the remainder 43,401,400 young salmon were planted this spring and summer in the river and lake near the hatchery. The period of planting extended from February to July, 1914, and so far as facilities would permit the fish were fed from 4 to 10 weeks before their release. Additional ponds are required before all the fry can be held and reared to fingerling size. From the 5,280,000 humpback eggs taken at Ketchikan Creek in September 1913, 4,500,000 fry were planted in January, 1914.

As a result of operations at the Yes Bay station in the fall of 1914 41,300,000 sockeye eggs were taken. This was a much smaller number than usual and appears to have been due simply to the fact that for some unknown reason the run of salmon did not materialize this year in its ordinary proportions. The bay was closed throughout the season to commercial fishing; a man was stationed there to see that the closing order was duly observed.

When the eggs reached the proper stage of development they were put through a salt solution to remove all unfertilized and dead ones. This process is now a regular feature of the work, for it not only means a great saving in the labor of hand picking, but it improves the quality of the eggs. The operation consists simply of placing the eggs in the solution, which is of about one part of salt to nine parts of water, and as the specific gravity of the poor eggs is slightly less, they remain at the surface and are easily removed. Caution is necessary to have the solution of the correct density, or there will not be a thorough separation of the good and bad eggs.

In October a shipment of 3,000,000 sockeye eggs of this season's take was made to the Oregon Fish Commission.

The hatching equipment of 5,000,000 capacity, heretofore used at Ketchikan, was transferred this season to another rented building farther up Ketchikan Creek and racks were installed in the stream, but contrary to all expectations, no run of humpbacks developed. Arrangements were then made to take humpback eggs at Mink Creek, a tributary to Quadra Bay. As fast as the eggs were taken they were placed in long-distance shipping cases, each case holding 250,000 eggs; when a case was filled it was taken by a chartered power boat to Ketchikan, about 50 miles distant, where the eggs were transferred to the hatching troughs These trips to Ketchikan were made every day or two throughout the period of operations, which covered the month of September. The quality of the eggs was fairly good, for out of a collection of 2,600,000 the loss in eyeing at the hatchery was but 600,000. This was an interesting experiment, as heretofore it has been considered almost impossible to successfully move green salmon eggs any distance without a very heavy loss. The 2,000,000 eyed eggs were transferred the latter part of October to the Bureau's station at Birdsview, Wash By transplanting humpback salmon from southeast Alaska it is hoped that a run of humpbacks to Puget Sound waters may be established during the alternate lean years for this species.

Early in the year the feeding of 5 000,000 young salmon was undertaken. These fish were held in troughs in the hatchery and in the new ponds. The food at first consisted of steelheads and Dolly Varden trout ground to suitable size, but as this supply of food lasted only about eight weeks, the fish were then fed on do-over salmon, ground to suitable fineness, which diet was continued until the fish were liberated in the lake in July. At this time there remained about 700,000 fingerlings averaging two inches or more in length. Plants from the original 5,000,000 fry, which had been fed, were made along from time to time until the final plants in July.

During the collection of sockeye eggs in the fall of 1914, 30 barrels of spawned fish were salted for feeding to the fry next spring. If this food proves to be satisfactory, larger quantities may be prepared in subsequent seasons.

In the spring of 1914, three fry ponds were constructed, each being 60 feet long, 12 feet wide, and 2 feet deep at the upper end with sloping bottom, giving a depth of 2½ feet at the lower end. These ponds are lined with heavy plank and the bottoms and sides are caulked to make them water-tight. They are side by side in a series just below the hatchery and along the retaining wall which fronts the creek; the water supply is derived from the hatchery's overflow.

Among other fixed improvements has been the construction of a 16 by 28 foot addition to the east side of the hatchery for the accommodation of a new electric power plant consisting of a 12-inch turbine driving a dynamo capable of furnishing power for one hundred 16-candlepower lamps. All buildings and the grounds are now lighted by electricity.

On April 25 the new bunk house occupied by temporary employees was destroyed by fire, the cause of which was apparently a defective flue. The building was rebuilt later in the year.

AFOGNAK.

At the Afognak station during 1913 the take of sockeye-salmon eggs numbered 10,989,000. Plants of fry resulting from these eggs were made chiefly from February to June, 1914, and aggregated 7,761,700. In addition 12,034,399 humpback salmon fry, which resulted from the 13,900,000 humpback eggs taken the previous season, were planted, mostly during the month of May. Also in February plants of 50,000 coho fry were made from the 74,600 eggs collected in the previous fall. Operations at the hatchery were much hampered by reason of the influx of volcanic ash, a fresh deposit of which resulted from another, though less violent, eruption of Mount Katmai in September, 1913. This ash was so troublesome that part of the fry had to be taken out as soon as possible.

It was anticipated that the egg-collecting season of 1914 would be much better than the previous year, as the run of sockeye salmon appeared nearly a month earlier and the commercial fishery was much more productive. The collection of sockeye eggs, however, was disappointing, as it numbered but 7,390,000. The wash of volcanic ash no doubt had much to do with this small take. A collection of 6,574,600 humpback eggs was made, which was considerably under the take of the previous year. The spawning season of salmon at Afognak extended over the period from August 1 to October 23.

Late in October a shipment of 12,500,000 eyed humpback eggs was made to Seattle, part of which were transferred to the Bureau's stations on waters tributary to Puget Sound, while the remainder were sent to one of the hatcheries in Maine. This shipment was made up of the eyed eggs resulting from a collection of 7,400,000 made for the Bureau at the Karluk hatchery, and from the 2,534,000 green eggs taken at Uganik. Full payment was made by the Bureau for the eggs obtained from the private hatchery at Karluk.

A supply of Dolly Varden trout was salted for use next season in feeding young salmon at the hatchery.

UGANIK.

Operations for the collection of humpback eggs were begun at Uganik in August. It was decided to undertake no sockeye-salmon work there this season, but probably in the future something will be done along this line, as the Uganik field offers some promise for fair collections of sockeye eggs. The take of humpback eggs at Uganik this year was 2,534,000, the first being obtained on August 26. In October, after the eggs were eyed, they were transferred to Afognak for shipment to the States.

The hatchery equipment established last year at Uganik Lake was moved down to tidewater this season, as it was found that by the time the fish got up to the old location some of them had spawned. The capacity of the troughs at Uganik is about 3,000,000 salmon eggs.

EAGLE LAKE.

The field station established last year at Eagle Lake on Kodiak Island was not in use this year, as the deposit of volcanic ash was too heavy to justify operations. It is doubtful whether this field will show any notable importance for several seasons to come.

FORTMANN.

The Alaska Packers Association operates the Fortmann hatchery on Heckman Lake of the Naha system, about 8 miles from Loring, in southeast Alaska. With a capacity of more than 110,000,000 eggs, this is the largest salmon hatchery in the world. It was established in 1901 and has been in continuous operation since that time. During the period from August 24 to October 16, 1913, a total of 9,480,000 sockeye-salmon eggs were taken. From this collection there were hatched and liberated in 1914 a total of 8,700,000 young fish. The loss of 780,000 is thus 8.23 per cent. The fry from the hatching troughs pass into nursery ponds, where they are fed on prepared fish, and in the course of time they are planted in waters of the Naha system, eventually to work down into tidal waters and out to their ocean habitat.

The season of 1913 was quite unsuccessful in the number of eggs taken, but in 1914 conditions in this respect improved somewhat, as during the period from August 22 to November 30 a take of 22,500,000 sockeye eggs was obtained. The average number of eggs per female spawned was 2,650. The first eggs taken hatched in 97 days in a mean water temperature of 45° F. But even with the larger collection of eggs this year over 1913, returns as compared with some seasons were regarded as disappointing. The small number of eggs taken was due to incessant rains causing very high water, which made seining for spawning fish difficult and permitted many of them to enter the natural spawning streams before they could be captured for hatchery use. Thus it will be seen that weather conditions as well as the number of fish available have much to do with the collections of salmon eggs at all hatcheries.

KARLUK.

The Karluk hatchery, operated by the Alaska Packers Association, is located on Karluk River about 2 miles above the mouth of that stream near the western end of Kodiak Island. This is a well-equipped station of 50,000,000 salmon eggs' capacity, which has been in operation continuously for 19 years. The shadow of a doubt rests upon the high efficiency of this hatchery, not through any fault in its operation or management, but because of its unfavorable location, practically on salt water, and the consequent impossibility for the young sockeye salmon to remain for a year in fresh water when released, as is their habit under normal circumstances. The fry, after hatching, are allowed to remain in ponds for a time, but this is not enough to compensate for the benefits which they would otherwise derive from a season's stay in a fresh-water lake. On account of the character of the country, it is impracticable to transport the fry from the hatchery overland to Karluk Lake, a distance of about 18 miles. It is probable that before many years the hatchery will be moved to the lake.

During the season from June 21 to October 11, 1913, there was a take of 34,629,160 sockeye-salmon eggs, from which there were liberated in 1914 a total of 31,546,080 fry. The loss was thus

3,083,080, or 8.9 per cent. All fry from the hatchery were liberated in Karluk River after being retained in ponds until they were free-swimming. The season of 1914 shows a decline in the collection of sockeye eggs, as the number obtained from June 27 to September 30 was 30,240,000. The average number of eggs per female spawned was 2,542. The young fish resulting from this take of eggs will be planted early in the coming year.

Upon request of the Bureau, a collection of humpback-salmon eggs was made at Karluk during the period from August 24 to September 8, 1914. Approximately 5,000,000 eyed eggs resulted from this collection, and in November they were sent to Seattle along with collections from the Afognak hatchery, for shipment to Maine, where an effort is being made to establish this species of Pacific salmon in the waters of the Atlantic.

Quadra.

Again in 1914, as was the case in 1913, a highly successful collection of sockeye-salmon eggs was made at the Northwestern Fisheries Co.'s hatchery at Quadra. Egg taking in 1914 began August 5, six days earlier than the previous year, and by October 11 there had been obtained 21,300,000 sockeye eggs, the largest collection in the history of the station. The hatchery proper was filled to its capacity with 20,400,000 eggs, and in addition 14 baskets were set up in an extra line outside of the building along the wall and filled with 900,000 eggs, all of which were in good condition. Weather conditions were favorable this year to a good take of eggs. The only untoward incident was a scarcity of ripe males part of the season, but this did not prove to be serious.

The previous record for the Quadra hatchery was in 1913, when 18,400,000 eggs were taken, which up to that time far exceeded the collection of any previous season. From this take there was a loss of 608,000 eggs, or 3.3 per cent, which shows very efficient work. The resulting 17,054,000 fry were deposited in the ponds adjacent to the hatchery, whence they subsequently went into the waters of the lake. The first plant occurred December 1, 1913, and other deposits were made through the early months of 1914.

Of the seven hatcheries in Alaska, both Government and private, the Quadra hatchery has been the only one in the last two seasons to obtain capacity takes of eggs.

Hetta.

Egg-taking operations continue later at Hetta than at any other hatchery in Alaska, extending usually into the month of December. Up to December 18, 1914, the total take of sockeye eggs was 7,438,500.

This is a better take than that made in 1913 when 4,082,000 eggs were obtained. The eggs began to hatch on November 9, 1914, and at the end of the year approximately 3,000,000 had hatched, and losses had aggregated about 200,000. From the take of 1913 a total of 3,590,500 fry had been liberated at the close of the fiscal year's records on June 30. The fry were held in rearing ponds for some time before being planted.

The extent of fish-cultural operations at Hetta is limited because of heavy commercial fishing by purse seines in Hetta Inlet off the mouth of Hetta River. In recent years the average catch of sockeye salmon at this point has been slightly upward of 50,000 per annum. Judging from the hatchery records it is likely that the number of adult sockeyes escaping the fishermen's nets and reaching the lake has not been over 10,000 each season for a number of years past. The placing of greater restrictions upon commercial fishing operations will undoubtedly mean an increased take of eggs. A study of figures and data at hand lead to the general conclusion that for every million eggs taken at a hatchery, there must be an escapement of approximately 1,000 adult sockeye salmon. This number includes both sexes. The closing of Hetta Inlet waters to commercial fishing will improve the efficiency of the hatchery and will be of ultimate benefit to the salmon fishery generally throughout the region.

The Hetta hatchery is operated by the Northwestern Fisheries Co. along modern lines. New buildings were completed in 1913 and the water supply and fry ponds are appropriate to the needs of a well-equipped hatchery having a capacity of about 12,000,000 sockeye salmon eggs. If more spawning fish become available, the capacity of the station can be increased considerably with but comparatively little difficulty. Detailed descriptions of the buildings and equipment appeared in the Bureau's 1912 and 1913 reports on the Alaska fisheries.

KLAWAK.

At the Klawak hatchery during the period from August 8 to September 29, 1913, operations resulted in a take of 3,645,000 sockeye-salmon eggs. These eggs were placed in the hatching baskets and during the period from January 1, 1914, to May 1, 1914, there were planted in streams tributary to the hatchery lake 3,465,000 sockeye-salmon fry, all in first-class condition. The loss of eggs through the period of incubation was approximately 4.9 per cent. The egg-collecting season of 1914 resulted in a take of 3,816,000 sockeye-salmon eggs.

The Klawak hatchery is operated under the direction of the North Pacific Trading & Packing Co., but a half interest in the enterprise is owned by the North Alaska Salmon Co. The hatchery has a capacity of about 10,000,000 sockeye salmon eggs. A rearing pond, 16 by 24 feet in size, in front of the building, receives the fry as they are removed from the hatching baskets. The construction of another rearing pond would prove of advantage in handling the hatchery's output.

GENERAL STATISTICS OF THE ALASKA FISHERIES IN 1914.

The total investment in the Alaska fisheries in 1914 was $37,038,632, a decrease of $8,673 from 1913. Of this investment approximately 86 per cent was in the salmon industry. The number of persons engaged in 1914 was 21,200, as compared with 21,721 in 1913, a decrease of 521 persons for 1914. The total value of the products in 1914 was $21,242,975 as against $15,739,068 in 1913, an increase in 1914 of $5,503,907. This is the greatest value ever shown for any one year of the fisheries products, proper, of Alaska. The pronounced increase this year was due to the large pack of red salmon and the high price commanded by all species of canned salmon.

Summary of Investments in the Fisheries of Alaska in 1914.

Industries.	Southeast Alaska.	Central Alaska.	Western Alaska.	Total.
Salmon canning	$11,743,329	$5,692,159	$13,394,947	$30,830,435
Salmon pickling	48,398	38,650	199,308	286,356
Salmon mild curing	753,589	2,325	21,650	777,564
Herring fishery	203,045			203,045
Halibut fishery	2,744,055			2,744,055
Cod fishery		623,921		623,921
Whale fishery	845,623		611,026	1,456,649
By-products	116,607			116,607
Total	16,454,646	6,357,055	14,226,931	37,038,632

Summary of Persons Engaged in the Fisheries of Alaska in 1914.

Races.	Southeast Alaska.	Central Alaska.	Western Alaska.	Total.
Whites	5,632	1,875	3,671	11,178
Natives	3,055	585	544	4,184
Japanese	680	249	389	1,318
Chinese	903	331	904	2,138
Miscellaneous	517	328	1,537	2,382
Total	10,787	3,368	7,045	21,200

SUMMARY OF PRODUCTS OF THE ALASKA FISHERIES IN 1914.

Products.	Quantity.	Value.
Salmon:		
Canned.......cases..	4,056,653	$18,920,589
Mild cured.......pounds..	3,272,800	300,052
Pickled.......barrels..	26,362	252,662
Fresh (including local).......pounds..	1,934,733	74,375
Frozen.......do....	228,528	8,551
Dry-salted.......do....	12,200	810
Dried, pickled, and smoked backs.......do....	40,000	1,490
Halibut:		
Fresh (including local).......do....	10,223,355	557,485
Frozen.......do....	4,437,468	215,744
Dry-salted.......do....	346,170	6,697
Fletched.......do....	50,804	2,831
Cod.......do....	15,045,378	438,208
Herring.......do....	6,374,780	60,610
Herring oil.......gallons..	192,662	38,532
Herring fertilizer.......pounds..	1,926,000	24,075
Whale oil.......gallons..	632,400	182,690
Sperm oil.......do....	162,750	66,727
Whale fertilizer.......pounds..	2,122,000	41,682
Whalebone.......do....	35,000	26,250
Trout.......do....	96,606	5,758
Black cod.......do....	87,573	4,743
Clams.......do....	2,880	300
Miscellaneous fresh fish, local.......do....	75,000	6,000
By-products oil.......gallons..	4,850	1,188
By-products fertilizer and meal.......pounds..	308,000	4,926
Total.......	....	21,212,975

SALMON INDUSTRY.

In reviewing the salmon industry of Alaska for 1914, several notable features at once arrest attention. The most important perhaps of these is the remarkable pack of red salmon in the Bristol Bay region. This is the third consecutive season for a large pack of reds on Bristol Bay and exceeded all anticipations, for, judging by previous experiences, a lighter run was to be expected, especially since the runs of 1909 and 1910, as judged by the catch, were not large. Thus, upon the assumption that salmon return in the fourth and fifth years, it would not have been surprising if 1914 had been a lean season. The approximate catch of red salmon in the Bristol Bay region in 1909 was 15,600,000 and in 1910 it was 11,600,000. In 1911 it dropped to 9,000,000, but in 1912 developed the surprising total of 19,900,000. In 1913 the number increased still more to 21,500,000 and in 1914 it was 20,900,000. These increases in catch in the last three years are not due to any particularly great expansion of operations, but seem simply to show much larger runs of salmon. The number of salmon canned in western Alaska in 1914 was greater than ever before, but the pickled product fell off considerably, owing to low prices and consequent lessened activity in this line. The facilities of some of the western Alaska canneries were taxed to the utmost during the run of reds this season.

Another noteworthy matter in 1914 was the light run of humpback salmon in southeast Alaska, where the catch of this species decreased nearly 50 per cent as compared with 1913. The take of pinks in central and western Alaska, however, improved this year. That 1914 was due to be an off year for pinks on Puget Sound was expected, but it was hardly thought that southeast Alaska would also be affected to any noticeable degree. This condition fortunately was offset to a certain extent by a good supply of chums, the catch in southeast Alaska being more than double that of last season.

There was also an improved catch of cohos this year. At a few plants canning operations were continued into October in an effort to get more chums to offset the shortage of pinks. The run of pinks in central Alaska was better this year than last; not only was the catch of red salmon in central and western Alaska better this year also, but, in addition, southeast Alaska showed a notable increase in the catch of reds. A number of canneries, particularly in the Icy Strait region, enjoyed the benefit of a good pack of reds. The catch of king salmon was better this year, but as the war in Europe lessened greatly the demand for a mild-cured product, more king salmon were canned than usual.

SALMON CANNING.

Changes in Canneries.

One new cannery was built and put in operation in Alaska during 1914. This was the plant of the George Inlet Packing Co., located at George Inlet, a few miles from Ketchikan. The canneries of the Point Ward Packing Co., located at Point Ward, and the G. W. Hume Packing Co., at Nakat Harbor, which were not operated in the season of 1913, were reopened in 1914. The latter establishment previously had been run under the firm name of the Herbert Hume Packing Co. The cannery of the Swift-Arthur-Crosby Co., on Heceta Island, which was operated only as a mild-cure plant in 1913, resumed canning in 1914. The canneries of the Shakan Salmon Co., at Shakan, and the Kasaan Co., at Kasaan, are now reported under the firm name of Gorman & Co. The cannery of the Walsh-Moore Canning Co., at Ward Cove, was operated under the name of the Ward Cove Packing Co., and the Sanborn-Cutting Co. took over the cannery operated by the Kake Packing Co. at Kake. The canneries of the Admiralty Trading Co., at Gambier Bay, and the Skowl Arm Packing Co., at Skowl Arm, which were operated in 1913, were closed throughout the season of 1914.

New Equipment.

Each season marks the substitution of more of the so-called sanitary machinery for the older type of equipment using soldered cans. The sanitary system is generally regarded as superior, both in respect to the quality of product and economy in preparation. Most of the pack of Alaska salmon is now put up in sanitary cans.

Disasters and Losses in the Salmon Industry.

The aggregate of losses this year shows an increase over 1913, when the chief losses consisted of three cannery tenders. But considering the enormous extent of the work and the large number of persons engaged, and taking into account the natural difficulties constantly confronting the industry in Alaska, the losses are strikingly small.

In the Bristol Bay region five fishermen were drowned, while in central Alaska two cannery employees were lost in this manner. In southeast Alaska three fishermen were drowned.

The cannery of the Kuiu Island Packing Co., located at Beauclaire on Kuiu Island, was destroyed by fire on October 21, 1914. Some of the smaller buildings were saved, but a loss of approximately $50,000 was sustained. Operations for the season were at an end when the disaster occurred. The cannery was built in 1912 and made its first pack that season.

On May 14, while en route from San Francisco to Bristol Bay, the bark *Paramita* of the Bristol Bay Packing Co. stranded at Lost Harbor on the western shore of Akun Island. Assistance was rendered by revenue cutters, but the vessel eventually became a total loss. No lives were lost. The loss of cannery material, including coal, empty cans, tin plate, box shooks, and various other items of equipment, together with the vessel, amounted to approximately $50,000. The *Paramita* was of 1,444 net tons and was built in Maine in 1879.

In addition to the foregoing, a number of canneries sustained minor losses in the way of fishing gear, scows, small boats, and other items of equipment.

Canneries Operated in 1914.

Southeast Alaska	44
Central Alaska	14
Western Alaska	23
Total	81

Companies Canning Salmon in Alaska, Number and Location of Canneries Operated, and Number of Traps Owned by Each.

Names.	Canneries.	Location.	Traps.
Southeast Alaska:			
Alaska Fish Co	1	Waterfall	1
Alaska Pacific Fisheries	3	Chilkoot Inlet	[a] 7
		Yes Bay	[b] 7
		Chomley	[b] 5
Alaska Packers Association	2	Loring	[c] 7
		Wrangell	[d] 5
Alaska Sanitary Packing Co	1	Wrangell	5
Astoria & Puget Sound Canning Co	1	Excursion Inlet	5
F. C. Barnes Co	1	Lake Bay	3
Deep Sea Salmon Co	1	Ford Arm	[e] 6
Fidalgo Island Packing Co	1	Ketchikan	3
George Inlet Packing Co	1	George Inlet	
Gorman & Co	2	Shakan	2
		Kasaan	4
Hawk Fish Co	1	Hawk Inlet	4

[a] 3 floating. [b] All floating. [c] 6 floating. [d] 4 floating. [e] 2 floating.

COMPANIES CANNING SALMON IN ALASKA, NUMBER AND LOCATION OF CANNERIES OPERATED, AND NUMBER OF TRAPS OWNED BY EACH—Continued.

Names.	Canneries.	Location.	Traps.
Southeast Alaska—Continued.			
Hidden Inlet Canning Co	1	Hidden Inlet	....
Hoonah Packing Co	1	Hoonah	[a] 7
G. W. Hume Co	1	Nakat Harbor	....
Irving Packing Co	1	Karheen	2
Kuiu Island Packing Co	1	Beauclaire	....
Lindenberger Packing Co	2	Roe Point	[b] 3
		Craig	1
Geo. T. Myers & Co	1	Chatham	3
North Pacific Trading & Packing Co	1	Klawak	....
Northwestern Fisheries Co	4	Hunter Bay	....
		Quadra	1
		Santa Ana	[a] 1
		Dundas Bay	4
Pacific American Fisheries	1	Excursion Inlet	18
Pacific Coast & Norway Packing Co	1	Petersburg	2
Pillar Bay Packing Co	1	Pillar Bay	3
Point Ward Packing Co	1	Point Ward	1
Pure Food Fish Co	1	Ketchikan	1
Sanborn-Cram Co	1	Burnett Inlet	[c] 6
Sanborn-Cutting Co	1	Kake	....
Starr-Collinson Packing Co	1	Moira Sound	[b] 2
Sunny Point Packing Co	1	Chomley	1
Swift-Arthur-Crosby Co	1	Heceta Island	....
Taku Canning & Cold Storage Co	1	Taku Harbor	[b] 10
Tee Harbor Packing Co	1	Tee Harbor	7
Thlinket Packing Co	1	Funter Bay	18
Ward Cove Packing Co	1	Ward Cove	....
Wiese Packing Co	1	Rose Inlet	2
Yakutat & Southern Ry. Co	1	Yakutat	....
Central Alaska			
Alaska Packers Association	4	Kasilof	13
		Larsen Bay	....
		Alitak	1
		Chignik	3
Columbia River Packers Association	1	Chignik	3
Fidalgo Island Packing Co	1	Port Graham	3
Kadiak Fisheries Co	1	Kodiak	....
Libby, McNeill & Libby	1	Kenai	10
Northwestern Fisheries Co	4	Orca	....
		Kenai	11
		Uyak	....
		Chignik	3
Pacific American Fisheries	1	King Cove	4
Seldovia Salmon Co	1	Seldovia	6
Western Alaska:			
Alaska Fishermen's Packing Co	2	Nushagak Bay	....
		Kvichak Bay	....
Alaska Packers Association	8	Nushagak Bay (2)	5
		Kvichak River (2)	....
		Naknek River (3)	....
		Ugaguk River	....
Alaska-Portland Packers Association	1	Nushagak Bay	3
Alaska Salmon Co	1	Wood River	....
Bristol Bay Packing Co	1	Kvichak Bay	....
Columbia River Packers Association	1	Nushagak Bay	....
Midnight Sun Packing Co	1	Kotzebue Sound	2
Naknek Packing Co	1	Naknek River	....
North Alaska Salmon Co	4	Nushagak Bay	....
		Kvichak River (2)	....
		Ugaguk River	....
Northwestern Fisheries Co	1	Nushagak Bay	....
Pacific American Fisheries	1	Port Moller	3
Red Salmon Canning Co	1	Ugashik River	....

[a] 1 floating. [b] 2 floating. [c] All floating.

CANNERIES NOT OPERATED IN 1914.

Six of the canneries in southeast Alaska were not operated this year, as follows:

	Location of plant.
Admirality Trading Co	Gambier Bay.
Canoe Pass Packing Co	Canoe Pass.
Metlakahtla Industrial Co	Metlakahtla.
Revilla Fish Products Co	Ketchikan.
Skowl Arm Packing Co	Skowl Arm.
St. Elias Packing Co	Dry Bay.

With the exception of the Admiralty Trading Co. and the Skowl Arm Packing Co., which were closed for the first time this season, the foregoing plants have not been operated for two years.

SALMON CATCH AND FORMS OF GEAR.

In southeast Alaska there were in operation 136 stationary and 41 floating traps in the salmon-canning industry, and 1 stationary trap each in mild-cure and pickling operations, or a total of 179 traps; in central Alaska there were 60 stationary traps in the canning industry; and in western Alaska there were 13 traps devoted to the canning industry, all stationary. Assembling these figures, there is a total of 211 stationary and 41 floating traps, or a grand total of 252 traps for all of Alaska for the year 1914. In 1913 there were in operation 231 stationary and 36 floating traps, or a total of 267 traps. Thus it will be noted that in 1914 there were 15 traps less in operation than in 1913. The number of stationary traps was 20 less, but there was a gain of 5 floating traps. It is of interest to note that southeast Alaska shows a gain of 16 traps, but as central Alaska fell off 27 and western Alaska 4, there was a net loss of 15 traps for 1914. The chief place of this decline was at Chignik.

The total number of purse and drag seines operated in Alaska in 1914 in the salmon industry was 336 as compared with 238 the previous year. This gain of 98 for 1914 may be accounted for, in part, by the presence of more purse seiners from Puget Sound, where it was known that an off season for salmon was due. Figures for the proportion of catch by the principal forms of gear show that in southeast Alaska the total catch by seines dropped from 48 per cent in 1913 to 47 per cent in 1914; also that the trap catch decreased from 50 per cent in 1913 to 48 per cent in 1914. The proportion of the catch by gill nets in this section, however, increased from 2 per cent in 1913 to more than 3 per cent in 1914. The catch by lines was about 1½ per cent. In central Alaska the seine catch decreased from 47 per cent in 1913 to 36 per cent in 1914, while the trap catch increased from 46 per cent in 1913 to 56 per cent in 1914. Also, the gill-net catch increased from 7 per cent in 1913 to 8 per cent in 1914. In western Alaska the noteworthy feature was the increase in the catch by means of seines, a form of apparatus first used to any extent in this part of Alaska in 1912. The proportion of the catch by seines increased from 2 per cent in 1913 to 4 per cent in 1914. The catch of 4 per cent by traps was practically the same both in 1913 and 1914, but the catch by gill nets decreased from 94 per cent in 1913 to 92 per cent in 1914. The increase in the seine catch makes up for the decrease in the gill-net catch. Present indications are that there will be a growing use of purse seines in western Alaska.

Of the entire catch of salmon in Alaska in 1914, 27 per cent were taken by seines, 31 per cent in traps, 41 per cent in gill nets, and less than 1 per cent by lines and dip nets. The previous year seines took 30 per cent, traps 32 per cent, and gill nets 36 per cent. In comparing these two seasons it will be noted that the catch by seines decreased from 30 per cent in 1913 to 27 per cent in 1914, and similarly traps showed a decrease from 32 per cent in 1913 to 31 per cent in 1914. The proportion of the gill-net catch in 1914 increased to 41 per cent, as compared with 36 per cent in 1913. This was brought about very largely by the fact that in western Alaska, where gill nets are used extensively, the run of salmon was very good, while in southeast Alaska where the catch is chiefly by seines and traps, the run of pink salmon fell off nearly one-half in 1914.

The total catch of salmon in 1914 was 54,651,915, as compared with 59,915,128 in 1913, a decrease of 5,263,213. In 1914 gains of approximately 3,350,000 chums, 1,230,000 reds, and 500,000 cohos were recorded, but kings fell off 22,000 and pinks decreased 10,325,000.

SALMON TAKEN IN 1914, BY SPECIES AND APPARATUS, FOR EACH GEOGRAPHIC SECTION OF ALASKA.

Apparatus and species.	Southeast Alaska.	Central Alaska.	Western Alaska.	Total.
	Number.	*Number.*	*Number.*	*Number.*
Seines:				
Coho, or silver	227,867	40,308	....	268,175
Dog, or chum	3,837,585	64,327	1,906	3,903,818
Humpback, or pink	5,495,773	1,918,681	1,973	7,416,427
King, or spring	6,336	6,821	7,708	20,865
Red, or sockeye	1,044,005	1,235,083	1,008,528	3,287,616
Total	10,611,566	3,265,220	1,020,115	14,896,901
Gill nets:				
Coho, or silver	161,549	52,546	107,988	322,083
Dog, or chum	83,725	....	384,143	467,868
Humpback, or pink	25,120	2,948	420,268	448,336
King, or spring	45,767	24,569	97,325	167,661
Red, or sockeye	451,703	680,690	19,931,337	21,063,730
Total	767,864	760,753	20,941,061	22,469,678
Traps:				
Coho, or silver	472,425	226,614	8,208	707,247
Dog, or chum	1,477,857	242,125	180,944	1,900,926
Humpback, or pink	6,987,998	1,684,612	142,757	8,815,367
King, or spring	24,377	24,202	7,787	56,366
Red, or sockeye	1,968,826	2,924,283	529,523	5,422,632
Total	10,931,483	5,101,836	869,219	16,902,538
Lines:				
Coho, or silver	47,161	....	....	47,161
King, or spring	275,637	....	....	275,637
Total	322,798	....	....	322,798
Dip nets:				
Red, or sockeye	....	60,000	....	60,000
Total:				
Coho, or silver	909,002	319,468	116,196	1,344,666
Dog, or chum	5,399,167	306,452	566,993	6,272,612
Humpback, or pink	12,508,891	3,606,241	564,998	16,680,130
King, or spring	352,117	55,592	112,820	520,529
Red, or sockeye	3,464,534	4,900,056	21,469,388	29,833,978
Grand total	22,633,711	9,187,809	22,830,395	54,651,915

PERCENTAGE OF TOTAL CATCH OF SALMON BY THREE PRINCIPAL FORMS OF GEAR.

Apparatus.	Southeast Alaska.		Central Alaska.		Western Alaska.	
	1913	1914	1913	1914	1913	1914
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Seines	48	47	47	36	2	4
Traps	50	48	46	56	4	4
Gill nets	2	3	7	8	94	92

STATISTICS.

The number of canneries in operation in Alaska in 1914 was 81, as compared with 79 for 1913. The total investment declined from $31,341,670 in 1913 to $30,830,435 for 1914. The decrease was chiefly in southeast and central Alaska.

The number of persons employed in canning operations in 1913 was 16,513 and in 1914 the number was 16,307, a decrease of 206 persons, which occurred in central and western Alaska. Southeast Alaska shows a gain as compared with 1913, including an increase in the number of Indians employed. Of the Oriental element, there was a slight increase in the number of Chinese, but the number of Japanese employed was nearly 25 per cent less than in 1913.

In 1913 the pack of canned salmon was 3,739,185 cases, valued at $13,531,604, while in 1914 it was 4,056,653 cases, valued at $18,920,589, an increase of 317,468 cases and $5,388,985 in value. By sections, the case pack comparison is as follows: Southeast Alaska declined from 1,782,898 to 1,776,075 cases, a difference of 6,823 cases; central Alaska advanced from 447,249 to 658,791 cases, an increase of 211,542 cases; while in western Alaska there was an advance from 1,509,038 to 1,621,787 cases, an increase of 112,749 cases over the 1913 pack in that region. Comparisons by species show the following: The pack of cohos increased from 75,779 to 157,063 cases, a gain of 81,284 cases; chums went up from 290,918 to 663,859 cases, an advance of 372,941 cases; kings made a jump from 34,370 to 48,039 cases, a difference of 13,669 cases; while the most noteworthy advance was made in the red pack, which surpassed all records for this species in Alaska with a production of 2,201,643 cases as against 1,965,237 for 1913, an increase of 236,406 cases. Pinks declined from 1,372,881 in 1913 to 986,049 cases in 1914, or a decrease of 386,832 cases. The net increase for all species in 1914 was 317,468 cases.

The pack of salmon in 1914 is the largest ever recorded for Alaska, exceeding the high record of 1912 by 2,012 cases, while the total value this year, by reason of better prices, exceeds the value of the 1912 pack by $2,628,662.

INVESTMENT IN THE SALMON-CANNING INDUSTRY IN 1914.

Items.	Southeast Alaska.		Central Alaska.		Western Alaska.		Total.	
	No.	*Value.*	*No.*	*Value.*	*No.*	*Value.*	*No.*	*Value.*
Canneries	41	$3,565,649	11	$1,530,765	23	$3,131,447	81	$8,227,861
Working capital		4,440,836		1,962,100		5,591,341		11,994,277
Wages paid		1,901,308		964,029		2,498,961		5,364,298
Vessels:								
Power vessels over 5 tons	101	591,497	41	435,950	52	665,428	194	1,692,875
Net tonnage	1,977		1,606		2,947		6,530	
Launches under 5 tons	58	109,738	18	22,974	26	67,080	102	199,792
Sailing	7	198,800	11	419,299	34	838,469	52	1,456,568
Net tonnage	9,039		19,859		47,879		76,777	
Boats, sail and row	800	58,431	425	35,580	1,035	222,357	2,260	316,368
Lighters, scows, house boats	289	130,681	155	109,050	151	154,775	595	394,506
Pile drivers	37	176,748	29	71,192	19	42,375	85	290,315
Apparatus:								
Haul seines	58	17,565	48	18,946	6	4,163	112	40,674
Fathoms	9,490		11,094		240		20,824	
Purse seines	201	74,617	1	324			202	74,941
Fathoms	35,455		200				35,655	
Gill nets	200	26,008	249	10,915	1,679	160,597	2,128	197,520
Fathoms	31,035		16,890		229,771		277,696	
Traps, driven	136	338,510	50	111,035	13	17,954	199	467,499
Traps, floating	41	112,941					41	112,941
Total		11,743,329		5,692,159		13,391,917		30,830,435

PERSONS ENGAGED IN THE SALMON-CANNING INDUSTRY IN 1914.

Occupations and races.	Southeast Alaska.	Central Alaska.	Western Alaska.	Total.
Fishermen:				
Whites	814	675	2,235	3,724
Indians	1,306	197	61	1,564
Chinese	53			53
Japanese	25	1		26
Miscellaneous[a]	30			30
Total	2,228	873	2,296	5,397
Shoresmen:				
Whites	1,113	400	1,071	2,584
Indians	1,367	334	445	2,146
Chinese	850	331	903	2,084
Japanese	600	243	356	1,199
Miscellaneous[a]	487	328	1,536	2,351
Total	4,417	1,636	4,311	10,364
Transporters:				
Whites	268	110	146	524
Indians	8	8	1	17
Chinese			1	1
Japanese	1	2		3
Miscellaneous[a]			1	1
Total	277	120	149	546
Grand total:				
Whites	2,195	1,185	3,452	6,832
Indians	2,681	539	507	3,727
Chinese	903	331	904	2,138
Japanese	626	246	356	1,228
Miscellaneous[a]	517	328	1,537	2,382
Total	6,922	2,629	6,756	16,307

[a] Filipinos, Mexicans, Negroes, Porto Ricans, etc., are included under the miscellaneous heads.

OUTPUT OF CANNED SALMON IN 1914.[a]

Products.	Southeast Alaska.		Central Alaska.		Western Alaska.		Total.	
	Cases.	*Value.*	*Cases.*	*Value.*	*Cases.*	*Value.*	*Cases.*	*Value.*
Coho, or silver:								
½-pound flat	4,579	$30,869	....	....	....	....	4,579	$30,869
1-pound flat	285	1,481	....	....	....	....	285	1,481
1-pound tall	106,472	454,537	36,863	$163,887	8,864	$39,312	152,199	657,736
Total	111,336	486,887	36,863	163,887	8,864	39,312	157,063	690,086
Dog, or chum:								
½-pound flat	373	1,939	....	....	....	....	373	1,939
1-pound flat	5,568	21,158	....	....	....	....	5,568	21,158
1-pound tall	591,470	1,920,208	17,723	139,618	48,725	157,842	657,918	2,217,668
Total	597,411	1,943,305	17,723	139,618	48,725	157,842	663,859	2,240,765
Humpback, or pink:								
½-pound flat	2,103	12,405	....	....	....	....	2,103	12,405
1-pound flat	9,286	36,991	....	....	....	....	9,286	36,991
1-pound tall	749,911	2,614,196	196,368	695,015	28,381	100,509	974,660	3,409,720
Total	761,300	2,663,592	196,368	695,015	28,381	100,509	986,049	3,459,116
King, or spring:								
½-pound flat	1,061	8,706	....	....	2,082	11,689	3,143	20,395
1-pound flat	903	4,665	218	1,200	3,683	21,276	4,804	27,141
1-pound tall	10,067	47,992	10,950	49,511	19,075	96,066	40,092	193,569
Total	12,031	61,363	11,168	50,711	24,840	129,031	48,039	241,105
Red, or sockeye:								
½-pound flat	35,480	316,763	7,884	64,921	10,461	97,510	53,825	479,194
1-pound flat	35,430	221,108	12,340	86,000	16,901	105,811	64,671	412,919
1-pound tall	223,087	1,178,727	376,445	2,105,088	1,483,615	8,113,589	2,083,147	11,397,404
Total	293,997	1,716,598	396,669	2,256,009	1,510,977	8,316,910	2,201,643	12,289,517
Grand total	1,776,075	6,871,745	658,791	3,305,240	1,621,787	8,743,604	4,056,653	18,920,589

[a] All cases contain 48 cans. For the purpose of affording fair comparison, cases containing ½-pound cans have been reduced one-half in number.

OUTPUT OF CANNED SALMON, 1908 TO 1914.[a]

Product.	1908	1909	1910	1911	1912	1913	1914	Total.
Coho, or silver:	*Cases.*	*Cases.*	*Cases.*	*Cases.*	*Cases.*	*Cases.*	*Cases.*	*Cases.*
½-pound flat	105	....	163	1,574	2,719	3,587	4,579	12,727
1-pound flat	2,414	1,206	2,249	1,075	17	266	285	7,512
1-pound tall	66,309	55,350	111,614	131,259	163,462	71,926	152,199	752,119
Total	68,828	56,556	114,026	133,908	166,198	75,779	157,063	772,358
Dog, or chum:								
½-pound flat	....	....	....	....	2,795	985	373	4,153
1-pound flat	107	....	....	7,245	....	2,619	5,568	15,539
1-pound tall	218,406	120,712	254,218	316,550	661,838	287,314	657,918	2,516,956
Total	218,513	120,712	254,218	323,795	664,633	290,918	663,859	2,536,648
Humpback, or pink:								
½-pound flat	....	....	3,188	4,836	13,712	20,822	2,103	44,661
1-pound flat	569	....	7,900	9,437	....	3,258	9,286	30,450
1-pound tall	643,564	464,873	543,233	991,005	1,266,426	1,348,801	974,660	6,232,562
Total	644,133	464,873	554,321	1,005,278	1,280,138	1,372,881	986,049	6,307,673
King, or spring:								
½-pound flat	62	....	54	67	5,151	1,585	3,143	10,062
1-pound flat	....	....	....	....	....	....	4,804	4,804
1-pound tall	23,667	48,034	40,167	45,451	38,166	32,785	40,092	268,362
Total	23,729	48,034	40,221	45,518	43,317	34,370	48,039	283,228
Red, or sockeye:								
½-pound flat	10,909	8,193	22,320	13,601	28,024	29,041	53,825	165,943
1-pound flat	26,950	85,193	39,941	4,967	16,242	11,735	64,671	249,699
1-pound tall	1,613,911	1,611,916	1,388,006	1,296,750	1,856,089	1,924,461	2,083,147	11,774,280
Total	1,651,770	1,705,302	1,450,267	1,315,318	1,900,355	1,965,237	2,201,643	12,189,892
Grand total	2,606,973	2,395,477	2,413,053	2,823,817	4,054,641	3,739,185	4,056,653	22,089,799

[a] The ½-pound cans have been reduced one-half in number and treated as 1-pound cans.

Average Annual Price Per Case of Forty-Eight 1-Pound Cans of Salmon, 1905 to 1914.

Product.	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914
Coho, or silver	$3.20	$3.63	$3.91	$3.98	$4.07	$4.89	$5.67	$4.44	$3.45	$4.39
Dog, or chum	2.69	2.87	2.97	2.53	2.28	3.04	3.72	2.37	2.21	3.37
Humpback, or pink	2.95	3.00	3.16	2.69	2.40	3.15	3.94	2.55	2.58	3.50
King, or spring	3.28	3.78	4.18	4.20	4.32	5.34	6.48	5.37	4.04	5.01
Red, or sockeye	3.38	3.77	4.59	4.52	4.53	5.30	6.33	5.45	4.54	5.58

MILD CURING.

Extent and Methods.

The season of 1914 shows a considerable decline in the mild-cure industry as compared with the previous year, when a number of shore stations was built in southeast Alaska, and much activity was displayed in this field, not only by those experienced in mild-cure work, but by others who were not familair with the processes involved and who possessed only limited facilities for preparing their catch. The result was a very heavy output of mild-cured salmon, part of which did not measure up to the high standard of quality previously established. In consequence of this, the season of 1914 did not open quite as auspiciously as the previous year; and with the coming of the European war, operations almost without exception were suspended immediately, as it was realized that the principal market for mild-cured salmon would in all likelihood be practically closed. Subsequent events proved the correctness of these conclusions, as the demand for mild-cured salmon fell off very perceptibly, and the market was over stocked.

The important trolling grounds in the vicinity of Forrester Island were again the scene of much activity this season. This island is a Federal bird reserve and is under the control of the Department of Agriculture. Operations were conducted under the immediate direction of Game Warden Willett, of that department, who reached Forrester Island on May 23 and was on duty there until the end of August. A total of 457 permits were issued covering fishing operations within the reservation. At one time more than 400 fishermen were engaged. Each fisherman was required to paint his permit number distinctly on his boat, and a limit was placed on the catch. This was made possible through arrangements with the buyers, who fixed the number that would be purchased on the following day, which number was posted on the bulletin board. The prices agreed upon were as follows: Red kings, 20 pounds or over, $1; red kings under 20 pounds, 30 cents; white kings, 20 cents; cohos, 5 cents. An agreement was made with the buyers to the effect that if rowboat operators could furnish enough fish, none would be purchased from the power trollers. Two checkers on the boats operated by the buyers were able to prevent practically all surreptitious disposal of fish by power-boat trollers. No permits were issued this season to power boats, and although a few power boats were present there was practically no trouble this year as compared with previous seasons. The best run of king salmon did not materialize until August. It was too late to be of particular benefit to the fishermen, as about this time the war in Europe put an end to operations. In June most of the natives left the Forrester Island camp to work in near-by canneries.

The general work of mild-cure operations in southeast Alaska in 1914 has been well covered by a report from Mr. E. P. Walker, of the Bureau's force, with headquarters at Wrangell, and the following extract from this report is herewith reproduced:

> The king salmon, which is the species utilized in mild-cure operations, other than a relatively small quantity of coho salmon, is the largest of the five species of salmon entering the waters of southeast Alaska, and in 1914 the average weight of the king salmon was about 22 pounds. In certain sections of this district the fish were somewhat larger and in others much smaller. The early run, near Craig, averaged about 30 pounds, while the run at Cape Ommaney somewhat later in the season did not average over 15 pounds. King salmon are referred to as white meated or red meated accordingly as the flesh of the individual is a pale flesh color or a rich salmon color. The latter is the form especially sought after by the markets, as it retains its color perfectly, save when canned, and is rich and palatable. The white flesh is equally rich and valuable for food, but being less highly colored is not in demand by the market at the present time. Fortunately the white-fleshed individuals are in the minority, there being only about 10 to 15 per cent of the fish taken that are of this color. To some people the quality of the white-meated king salmon is considered superior, especially when eaten fresh, to any other salmon, and its lack of popularity may be attributed almost entirely to the absence of a rich, attractive color rather than to any fault in quality.
>
> Mild curing is the most important method by which the king salmon is now utilized. It is only during the past five years that the mild curing of king salmon in Alaska has become an important industry, but at the present time it has ranked next to canning as a method of preparing the salmon products of Alaska.
>
> The capture of king salmon is effected chiefly by two methods—trolling and gill netting. A few, however, are caught in traps along with the other salmon, and during the season just closed one person operated a trap for this species, but with indifferent results. The method of trolling, in brief, consists merely in pulling through the water slowly a hook baited with a herring or having an artificial spoon attached to it. The trollers are of two classes, those operating hand boats and those having power boats. The former have merely rowboats adapted to one person, from which the operator tows a single line carrying one hook. The power trollers have, as a rule, small power-propelled boats ranging from a mere rowboat in size to quite stanchly built little vessels of as much as 5 tons. The power troller has fitted to each side of the boat an outrigger or pole about 15 feet in length, projecting nearly horizontally, to the end of which is attached a trolling line. Frequently a third outrigger is placed vertically at the stern, to which is attached another line, thus enabling a power troller to operate at least three lines at once.
>
> The hand troller almost invariably plays a fish when hooked, thus tiring it out before attempting to remove it from the hook and insuring the landing of a high percentage

of the fish hooked. The power troller, however, does not thus play a fish, but immediately hauls in the line while the boat is going ahead at a speed much faster than that ever attained by the hand troller. If the fish is hooked securely enough, it is landed without delay; but if it is only slightly hooked or is an unusually vigorous one, it frequently escapes by tearing away from the hook. It is at once apparent that by this method many fish are hooked which escape with injuries and often subsequently die as a result. The average size of power-trolled fish is less than those trolled by hand, owing chiefly to the fact that great numbers of the larger and stronger fish hooked by the power trollers are able to tear themselves loose, while comparatively few are lost by the hand troller, who plays his fish.

The season for active trolling for king salmon begins the latter part of March and continues until late in June, depending somewhat on the weather and the different localities. The principal trolling grounds are the waters about Forrester Island, Cape Ommaney, Point Lemesurier, Point Caamano, Kashakes Point, Craig, Wrangell, and Sunny Bay. There are various other less important grounds, as king salmon may upon occasion be caught at almost any point in southeast Alaska, but more especially south of Wrangell Narrows. They may be caught throughout almost the entire year; in fact, there is not a month when king salmon may not be taken. In the fall and winter they may be caught at Snow Pass, Zarembo Island, Tongass Narrows, and other places. Early in February and March they begin running near Wrangell, and a short time after that the run at Craig and other outside points commences.

Trolling furnishes employment to probably not less than 1,500 persons in southeast Alaska each season. This number is estimated, as trollers are so widely scattered that it is practically impossible to make even a reasonably accurate census. There are hundreds of miles of coast line dotted with groups of camps of trollers or of scattered and single camps. The large number of persons engaged in this work may perhaps be accounted for by the fact that trolling operations can be engaged in successfully by those possessing quite limited capital, as the equipment is not expensive and suitable trolling grounds are not so limited as are suitable gill-netting grounds. The cost of a hand troller's complete equipment does not on an average exceed $90, allowing a valuation of $30 for the boat, $10 for gear, and $50 for camp equipment and incidentals possessed by most hand trollers. The power boats vary greatly in value, ranging from $150 to $2,000 each, the average probably being about $800.

Gill netting for king salmon is carried on in only two regions in southeast Alaska, namely, at the mouth of the Stikine River near Wrangell and in Taku Inlet near Juneau. In the former region the nets range from 250 to 600 fathoms in length, averaging about 375 fathoms, while in Taku Inlet, where there is much floating ice from the glacier, the nets are considerably shorter, averaging only about 190 fathoms in length, with a maximum of 300 fathoms. This region is much more restricted than the Stikine River grounds and does not afford good fishing to as large a number of boats.

Fishing with gill nets is carried on chiefly at either high or low tide and preferably at night or during the day if the water is sufficiently turbid to conceal the nets from the fish. In the Stikine region one fisherman, as a rule, lives on a boat, which is ordinarily but a large skiff powered with a small engine and having a small cabin forward. Such boats are valued at about $400 and have a carrying capacity of 2 to 3 tons. Some boats are of a much better type and are correspondingly more valuable, often costing as much as $4,000. Such boats generally carry a large skiff in which the gill net is stowed and from which it is set.

The mild-cure plants may be divided into two general classes—floating stations and shore stations. The latter are owned or operated chiefly by large companies. Of these are the stations that buy the fish in a fresh state and do their own mild curing as well as buying the mild-cured product put up by fishermen. There are also those which only buy fish mild cured by the fishermen and small operators. The floating stations vary in size from large scows or boats of considerable capacity to small power boats holding but a single tierce and operated by only one person and supplied entirely by that person's activity at trolling. The floating stations are either towed or go under their own power to the various fishing grounds and can scarcely be said to have any regular location. Under this arrangement the fish are brought directly to them by the fishermen as well as caught. The shore stations run regular boats to the fishing grounds, where the fish are bought of the fishermen and are then taken to the station for preparation. The greatest care must be exercised in handling salmon for mild-curing purposes if a desirable product is to be realized. The fish are cared for as soon as possible after capture. In their preparation the heads and gills are first removed; next the fins are cut off close to the body and the fish are opened in a straight line along the abdomen and the viscera removed. Following this, the sides are separated by cutting close along the backbone on each side, removing the backbone and leaving the two approximately equal sides of flesh containing only the ribs and the basal bones of the fins. From the cutting table the sides are put into a tank of fresh running water, from which they are taken for the final cleaning. In this process each side, or fletch, is carefully scraped under a stream of fresh water to remove any blood and loose tissues, following which an incision is made in the skin to allow the brine to penetrate, and the fletch is then placed in a heavy salt solution. After remaining in this brine from 5 to 10 hours the sides are then taken out and carefully packed in tierces, alternating with layers of fine salt, care being taken not to use so much salt that a hard salt product will result. They remain in this condition for about 15 days, when they are repacked and graded according to size in tierces with fresh salt. These tierces are then headed up and kept in a cool place until ready for shipment.

Mild-cured salmon may be served in various ways, and is not to be confused with the ordinary salt fish. It may be boiled and served as an excellent moderately salt fish or it may be prepared by the method most commonly employed by the German trade, which is to soak the sides slightly and then smoke it.

During the season of 1914 there was much waste of king salmon, both of the fresh fish and the mild-cured product. The German trade, which consumes by far the greater portion of this product, desires sides weighing not less than 6 or 7 pounds, so that when smoked and sliced the slices will be of a suitable size to put up neatly in a uniform package. There is a fair market for well-cured sides of 6 pounds and over, but in many cases fish that will not cut a 6-pound side are discarded, irrespective of price, although the quality of the smaller fish is fully as good or even better than the large ones. As has been previously indicated, the mild-cure market greatly prefers the red-meated fish. As a result, white-meated fish are frequently refused by the buyers and packers, although a few are taken at very low prices considering their real food value.

In the preparation of the fish about one-third of its total weight is waste and the remaining two-thirds is divided equally between the two sides. An 18-pound fish will therefore cut two 6-pound sides, and when in mild-cure operations sides of at least 6 pounds are desired, all fish under 18 pounds weight are discarded, and much waste therefore results. During this season the average weight of king salmon for all of southeastern Alaska was only about 22 pounds. On certain trolling grounds not over 20 per cent of the fish taken weighed 22 pounds, while on some other grounds the proportion of fish of this size was not much better.

When it is considered that many buyers have a minimum weight limit of 20 pounds per fish and a limit on the number of fish taken from each person per day, and are paying more for large fish than for small, it is at once seen that the fisherman will continue to fish, if possible, even after he has his per diem limit, in an effort to catch his limit of large fish rather than small. All of the smaller fish taken in excess of the limit will then be thrown overboard. The scale of prices at one station was as follows: Whites, 25 cents; reds, under 16 pounds, 25 cents; reds, between 16 and 20 pounds, 50 cents; and reds, over 20 pounds, $1. At another place the following prices prevailed:

Whites, 20 cents; reds, 20 to 40 pounds, $1; and reds over 40 pounds, $1.25. Thus one company was buying a limited number of red-meated fish under 20 pounds and the other none at all. With the 20-pound limit in force it was not an infrequent sight to see reds weighing as much as 19¾ pounds thrown overboard for no other reason than that they lacked 4 ounces of weighing 20 pounds. It is well known that in the last four years the average size of the king salmon caught has constantly decreased.

In the early part of the season of 1914 two stations purchased all fish offered to them by the fishermen, mild curing the red-meated ones of 20 pounds or over and disposing of the remaining small reds and whites to canneries. Later in the season after warning had been given that prosecutions would be commenced against those wasting fish, other stations began to take the small red-meated and the white-meated kings, disposing of them to canneries, in order that the fishermen might not be forced to cease operations.

The stations purchasing only fish already mild cured by the smaller individual operators and fishermen did not help matters in respect to waste, for the small mild curer prepared all his fish and offered them to the buyers, who would accept only the red sides weighing 6 pounds or over, thus leaving the remainder on the hands of the men preparing them, who, having no market, were forced to dump them overboard. It sometimes happened that as much as 50 per cent of the mild-cured fish prepared by a fisherman were thus wasted. There is much dissatisfaction among the fishermen and small operators with the treatment received at the hands of the buyers, as under present conditions much labor is involved for small compensation.

Another form of waste, but of less seriousness than that just described, results from the ignorance, carelessness, and inadequate equipment of many of the small operators. This was especially true in 1913, when the market was burdened with large quantities of poorly prepared fish as a result of the idea that anyone who could catch fish and put them in tierces was qualified to turn out a good product. This condition was somewhat better this season than in 1913, as there appeared to be a smaller quantity of inferior fish offered by the fishermen to the buyers than formerly. The lack of cold-storage facilities is frequently a serious handicap to the small operator who puts up mild-cured salmon.

Promptly upon the commencement of the European war all mild-cure operations ceased, owing to the fact that the industry was financed chiefly by European capital and was dependent almost entirely upon Germany for a market. At the end of the year practically all mild-cured salmon prepared this season remain unsold and with no immediate prospect of early disposition. This interruption of the foreign market should be taken advantage of to stimulate an American trade in this excellent food product.

The waste of king salmon mentioned in the foregoing is a serious matter, the remedy for which lies in prosecutions of all persons who indulge in the practice. The burden of this seems to fall upon the fishermen, since the buyers can not be forced to purchase fish they do not want, but as a matter of fact, if the fishermen are prosecuted the result is to practically stop trolling operations, and the chief burden thus rests upon the buyers, who are dependent upon the fishermen for their supply of fish. Notice was served upon the buyers last season of this intended course, and it forced them to make an effort to dispose of the small red-meated kings and whites to canneries. A number of them succeeded in doing this. Most of the fishermen saw the justice of the stand taken. They had scarcely made expenses when able to sell only their catch of large red-meated fish, and were not averse to the adoption of measures which would either compel them to cease operations or force the buyers to provide a market for all fish caught.

Principal mild-cure plants.—This season Engelbr. Wiese (Inc.) was again engaged more extensively in mild-cure operations than any other company. Operations were conducted at three plants, the most important being at Waterfall, and the other two at Port Conclusion and Hoonah. Of the other more important producers of mild-cured salmon were the Vendsyssal Packing Co., at Tyee; the Alaska Cooperative Fishing & Packing Co. and the Columbia & Northern Fishing & Packing Co., at Wrangell; the Diamond T Packing Co., and the Salmon Packing Co. (Ltd.), at Ketchikan; the Lindenberger Packing Co., at Craig; the Swift-Arthur-Crosby Co., at Warmchuck; the Taku Canning & Cold Storage Co., at Taku; and the Pacific Coast & Norway Packing Co. and Rasmus Enge, at Petersburg. M. B. Dahl was also engaged quite extensively, operating the schooner *Volante* (119 tons) as a floating mild-cure plant in southeast Alaska. Other floating plants were operated on scows by the Pacific Coast & Norway Packing Co. and by Regnor Dahl & Son. The Salmon Packing Co. (Ltd.), at Ketchikan, is a new company to enter the mild-cure field in Alaska. The Alaska Cooperative Fishing & Packing Co., at Wrangell, merits mention as being a cooperative organization chiefly of fishermen, which attempts to handle all properly prepared mild-cured salmon brought in by its members.

In central Alaska mild-cure operations were of modest proportions, the total product being approximately 100 tierces. Operations were conducted on Cook Inlet and on the Copper River.

In western Alaska the power schooner *Bender Bros.* was operated by J. E. Shields, of Seattle, in mild-cure work on the Kuskokwim River. Upward of 100 tierces were prepared, of which 20 tierces were of chum salmon. All fish were taken in the Kuskokwim River. Mild-cure operations in this remote section of Alaska are more hazardous than in southeast Alaska, where cold-storage facilities for handling the product are more accessible. This is the second year that the *Bender Bros.* has been operated on the Kuskokwim in mild-cure work.

STATISTICAL SUMMARY.

The investment in mild-cure work this year was $777,564, as compared with $1,165,866 in 1913. The number of fixed plants decreased from 20 in 1913 to 17 in 1914, this decline being in southeast Alaska. There was also a proportionate lessening in the total number of persons engaged from 2,644 in 1913 to 2,161 in 1914. Of the total, however, there was an increase this year in the number of Indians engaged as fishermen in southeast Alaska. The total product declined from 7,443 tierces in 1913, valued at $543,362, to 4,091 tierces in 1914, valued at $300,052, a decrease of 3,352 tierces and $243,310 in value. A tierce contains 800 pounds of salmon, net weight.

INVESTMENT IN THE SALMON MILD-CURING INDUSTRY IN 1914.

Items.	Southeast Alaska.		Central Alaska.		Western Alaska.		Total.	
	No.	*Value.*	*No.*	*Value.*	*No.*	*Value.*	*No.*	*Value.*
Fixed plants	15	$94,639	1	$500	1	$3,000	17	$98,139
Operating capital		240,750		1,000		5,000		246,750
Vessels:								
Power vessels over 5 tons	31	95,800			1	12,500	32	108,300
Net tonnage	344				96		440	
Launches under 5 tons	404	243,700	2	250	1	500	407	244,450
Sailing	1	3,500					1	3,500
Net tonnage	119						119	
Boats, sail and row	1,178	41,235	1	25	5	250	1,184	41,510
Lighters, scows, house-boats	10	4,200					10	4,200
Gear:								
Haul seines	1	400					1	400
Fathoms	600						600	
Purse seines	5	2,625					5	2,625
Fathoms	598						598	
Gill nets	229	16,495	2	550	20	400	251	17,445
Fathoms	21,770		550		600		22,920	
Trawl lines	4,612	9,245					4,612	9,245
Traps, staked	1	1,000					1	1,000
Total		753,589		2,325		21,650		777,564

PERSONS ENGAGED IN THE SALMON MILD-CURING INDUSTRY IN 1914.

Occupations and races.	Southeast Alaska.	Central Alaska.	Western Alaska.	Total.
Fishermen:				
Whites	1,699	2	4	1,705
Indians	312			312
Shoresmen:				
Whites	63	3	5	71
Indians	5		20	25
Transporters: Whites	47		1	48
Total	2,126	5	30	2,161

PRODUCTS OF THE SALMON MILD-CURING INDUSTRY IN 1914.

Species.	Tierces.	Pounds.	Value.
Southeast Alaska:			
King salmon	3,833	3,066,400	$287,274
Coho salmon	40	32,000	2,368
Total	3,873	3,098,400	289,642
Central Alaska: King salmon	102	81,600	6,120
Western Alaska: King salmon	[a] 116	92,800	4,290
Total	218	174,400	10,410
Grand total	4,091	3,272,800	300,052

[a] Includes 20 tierces chum salmon and 3 tierces of red salmon.

PICKLED SALMON.

The lessened demand for salt salmon in 1913 and the consequent weakening of the market resulted in a lack of interest in salting salmon in 1914. This was more noticeable in southeast and central Alaska, where there was a lighter run of pinks, which resulted in greater demands for canning purposes. In western Alaska the production of salt salmon was quite good, but no doubt this was due in part to the heavy run of reds, which at times could not be taken care of by the canneries. Later in the season the price on salt salmon improved materially over that obtained in 1913. The European war has been a factor in this advance.

In southeast Alaska this year the only concern to operate a salting enterprise other than in a more or less incidental way was the Holbrook Fish Co. Early in December this plant was partly destroyed by fire. In central Alaska the production of salt salmon was chiefly from the Copper River. Of the salteries in western Alaska, one was operated at Koggiung by the Alaska Salmon Co. as a floating plant on the schooner *Lizzie Vance,* a vessel of 383 tons.

SALMON BELLIES AND BACKS.

The so-called salmon belly, which consists of the abdominal walls of the fish cut in one piece and put up as a pickled product, is regarded by the initiated as quite a delicacy. The fact that fishermen and other cannery employees who go to Alaska for the fishing season often put up a kit or a small barrel of bellies to take home in the fall is evidence of the popularity of this article. The preparation of salmon bellies for the market is not conducted at present along very extensive lines in Alaska. In 1913, the product was 451 barrels, and in 1914 it was 406 barrels, valued at $5,454. These figures have been included in the table of pickled salmon shown elsewhere.

When salmon bellies are put up, it is required by the Department that the remaining edible portion of the fish must be utilized in order to observe the provisions of section 8 of the act of June 26, 1906, regarding the wanton waste or destruction of salmon or other food fishes taken or caught in any of the waters of Alaska. In accordance with this requirement of the law, it has been the practice when preparing bellies to make use of the backs, either dried, pickled, or smoked. The dried form is used ordinarily as dog feed. In 1914 the product of dried backs amounted to 9,000 pounds of cohos and 6,000 pounds of humpbacks, having a total value of $810. The production of pickled backs was 2,000 pounds of reds, 1,000 pounds of humpbacks, and 14,000 pounds of chums, the total value of which was $280. In addition, 8,000 pounds of red backs valued at $400 were smoked.

STATISTICS.

In 1914, there were 15 salteries in operation, as compared with 24 in 1913, and the investment declined from $445,377 to $286,356. The number of persons engaged decreased from 478 in 1913 to 248 in 1914. The output of pickled salmon also shows a proportionate reduction, for this year it was but 26,[illegible]62 barrels, valued at $252,662, as against 38,332 barrels, valued at $279,249, in 1913. It will be noted that although the quantity prepared in 1914 was about one-third less than the previous year, the value was only about 10 per cent less. Of this year's production of pickled salmon in Alaska, approximately 89 per cent came from the Bering Sea region, as compared with 77 per cent from that part of Alaska last year.

INVESTMENT IN THE SALMON PICKLING INDUSTRY IN 1914.

Items.	Southeast Alaska.		Central Alaska.		Western Alaska.		Total.	
	No.	*Value.*	*No.*	*Value.*	*No.*	*Value.*	*No.*	*Value.*
Salteries	4	$16,848	5	$10,500	6	$51,073	15	$78,421
Operating capital		14,000		17,500		88,000		119,500
Vessels:								
Power vessels over 5 tons	3	6,700	1	7,500	4	24,000	8	38,200
Net tonnage	28		40		3,763		3,831	
Launches under 5 tons	5	4,000	1	200	3	12,950	9	17,150
Sailing					1	9,000	1	9,000
Net tonnage					620		620	
Boats, sail and row	12	515	21	1,035	38	6,760	71	8,310
Lighters and scows	6	1,400	1	50	6	3,600	13	5,050
Gear:								
Haul seines	4	905	4	650			8	1,555
Fathoms	235		600				835	
Purse seines	7	1,050			1	100	8	1,150
Fathoms	830				75		905	
Gill nets	3	480	21	1,185	71	3,825	95	5,490
Fathoms	685		1,459		9,940		12,084	
Traps, driven	1	2,500					1	2,500
Trawl lines			1	30			1	30
Total		48,398		38,650		199,308		286,356

PERSONS ENGAGED IN THE SALMON PICKLING INDUSTRY IN 1914.

Occupations and races.	Southeast Alaska.	Central Alaska.	Western Alaska.	Total.
Fishermen:				
Whites	9	6	65	80
Natives	9	29	3	41
Total	18	35	68	121
Shoresmen:				
Whites	6	9	68	83
Natives	16	7		23
Total	22	16	68	106
Transporters:				
Whites		1	15	16
Natives		5		5
Total		6	15	21
Grand total	40	57	151	248

BARRELS[a] OF SALMON PICKLED IN 1914, BY SPECIES.

Products.	Southeast Alaska.		Central Alaska.		Western Alaska.		Total.	
	No.	*Value.*	*No.*	*Value.*	*No.*	*Value.*	*No.*	*Value.*
Coho, or silver	160	$1,140	205	$1,627			365	$2,767
Coho bellies			32	562	35	$420	67	982
Dog, or chum	39	195			14	98	53	293
Chum bellies	18	180					18	180
Humpback, or pink	399	2,456	83	498			482	2,954
Humpback bellies	173	1,876	56	744			229	2,620
King, or spring	30	210	31	329	208	2,049	269	2,588
King bellies					2	13	2	13
Red, or sockeye	16	184	1,557	16,597	23,212	221,812	24,785	238,593
Red bellies	4	88	88	1,584			92	1,672
Total	839	6,329	2,052	21,941	23,471	224,392	26,362	252,662

[a] Barrels holding 200 pounds of fish.

FRESH SALMON.

SHIPPED FROM ALASKA.

Although the shipment of fresh salmon to Puget Sound from Petersburg, Wrangell, Ketchikan, and Juneau is chiefly incidental to mild curing or other methods of handling, the industry is nevertheless of considerable importance. The fish are boxed in ice and are transported by regular steamship lines. The period of transit is less than three days and delivery in good condition is easily accomplished. In 1914 shipments of fresh salmon from Alaska aggregated 1,759,733 pounds, valued at $60,375. This is a substantial gain over 1913, when 645,956 pounds, valued at $51,727, were shipped.

MARKETED LOCALLY IN ALASKA.

Definite figures are not available as to the exact quantity of fresh fish distributed through the local markets in Alaska, but at the more important centers of population, such as Juneau and other cities, the amount consumed is of sufficient importance to warrant mention in this report. It is estimated that the consumption of fresh fish purchased either at local markets or from fishermen for use at the more important centers is 500,000 pounds, valued at $40,000. Of this quantity about 50 per cent is halibut, 35 per cent salmon, and 15 per cent miscellaneous fishes, such as black cod, herring, bass, and other species. Retail prices vary from 7 or 8 cents a pound for halibut to 10 or 12 cents for salmon.

FROZEN SALMON.

As for several years past, the freezing of Alaska salmon was conducted in 1914 in connection with other cold-storage business at a number of plants in southeast Alaska. These included the New England Fish Co. at Ketchikan, the Taku Canning & Cold Storage Co. at Taku Harbor, the Juneau Cold Storage Co. at Juneau, the Booth Fisheries Co. at Sitka, and the Columbia & Northern Fishing

& Packing Co. at Wrangell. The New England Fish Co. froze more than 100,000 pounds, while the other concerns produced less quantities in the order in which they are listed.

During 1914, the total quantity of salmon frozen in Alaska was 228,528 pounds, valued at $8,551. This shows a heavy decline from the season of 1913, when the product was 701,418 pounds, valued at $28,057. Conditions in 1913, however, were quite unusual, as the market for canned chum and coho salmon was unattractive, hence more attention was directed toward the freezing of these species.

SALMON FROZEN IN ALASKA IN 1914.

Species.	Pounds.	Value.
Coho salmon	125,918	$5,349
Chum salmon	89,644	2,676
King salmon	12,966	526
Total	228,528	8,551

DRY-SALT SALMON.

The Morrison Salting Co. dry salted 11,400 pounds of red salmon on the Chilkat River near Katalla, and at Idaho Inlet in southeast Alaska the Glacier Fisheries Co. similarly prepared 800 pounds of coho salmon. The total value of these products was $810. In 1913 the production of dry-salt salmon in Alaska was 21,282 pounds, valued at $1,235.

SALMON IN THE YUKON.

The salmon fisheries of the Yukon were the object of inquiry and investigation by Agent H. O. Smith, who made a trip, late in the season, up the river from St. Michael to White Horse. The statements which follow are based chiefly on notes made at that time.

The Yukon is navigable for large vessels of the Mississippi River type from St. Michael, on Bering Sea, to White Horse, in Yukon Territory, a distance of more than 2,000 miles. The river is narrow and swift at the latter point, but throughout most of its length is broad and rather sluggish. With the exception of one stretch of 70 miles, its waters find their way to the sea through various channels or beds which greatly increase the difficulties of navigation and make it necessary to use the sounding lead almost constantly. The stream empties into Bering Sea through a delta 70 miles wide, consisting of five main channels and numerous smaller streams. Throughout the greater part of its length the Yukon flows between low banks, which each season are receding considerably, chiefly because of the erosive effects of the ice break-up in early summer.

The species of salmon found in the Yukon are the chinook, coho, and chum, with occasionally a humpback. One fisherman operating a wheel said that he had not caught more than three or four humpbacks throughout the summer. The chinooks are used more than the other species for human consumption. They are found all the way up to the headwaters of the stream. The chinooks begin to run as soon as the ice disappears, generally from the first to the middle of June, and the run continues usually for 30 to 40 days. In September another run of this species appears for a shorter period.

The cohos and chums are the most numerous salmon in the Yukon and large quantities are easily secured, which are prepared for dog feed for use during the long winters of that latitude. Considering the great extent of the Yukon and its tributaries, demands in this direction are quite heavy, for mining camps and the dwellings of natives are scattered throughout this vast region.

Fishing in the Yukon is conducted almost altogether by means of small and rather primitive fish wheels, which are placed at various points along shore where the current is strong enough to keep them constantly in motion. The wheels are often located in specific places to catch the different species, as it has been found that the cohos are taken more plentifully along the sandy beaches, while the chums favor the rocky and rough banks. Therefore wheels are often set on one side of the river to catch chums and on the opposite side for cohos. In some places, however, no apppreciable difference in respect to these two species is noted.

The lower Yukon section, which is flat and subject to overflows, is sparsely populated by natives and but little fishing is done. The natives along this part of the river are improvident and shiftless. What little fishing they attempt is generally neglected, and part of the resulting light catch is usually sold to traders at 3 to 4 cents a pound. Along in the winter, when food runs low for themselves and their dogs, they often purchase the same fish back from the traders at 8 to 10 cents a pound, if they can scrape the money together. The lower Yukon is not as well adapted to the fishing methods and appliances of the natives as are the middle and upper reaches of the stream.

From Holy Cross up as far as Kaltag the greater part of the catch consists of chums, although there is a good sprinkling of cohos. In this part of the stream there are precipitous banks, and rough and rocky beaches. At Nulato, which is perhaps the leading fishing center of the Yukon, the catch is mostly cohos for here sandy beaches are more common. From Nulato to Ruby fishing is carried on more systematically than farther down stream, and the catches are much heavier. Smokehouses have been constructed, and the bright red appearance of the cohos, hanging on racks to dry, makes them much more inviting than the pale chums lower down the river. At Ruby cohos are taken along the shore adjacent to the town, while on the opposite side the chums run. The latter species is not much sought this far up because of the superior quality and appearance of the cohos, and because by this time the chums have become much more emaciated than the cohos. There, also, is so much less oil in their flesh that they make poor dog feed to say nothing of their being almost worthless as food for man. About the same conditions prevail up the Tanana River to Fairbanks. Conditions are similar farther up the Yukon but the catch is of diminishing importance both as to quantity and quality.

A sufficient quantity of fish is put up at almost all places to meet the demands of that part of the country and for those residing back in the interior. From Holy Cross to Ruby large quantities of salmon are dried and smoked for use, in the more remote regions where the supply is scarce, as in the lower Yukon country, at Nome, and other mining communities. The Iditarod region produces only a small quantity of fish, and it was said that this season about 60 tons would be shipped there from the upper Yukon.

Although there are quite good runs of chinook, coho, and chum salmon up the Yukon, it does not appear that the establishment of canneries would be profitable or advisable. The lack of transportation facilities and the high cost of putting up a pack would not justify the undertaking. Moreover, the wisdom of such an enterprise, at least along any extensive line is very doubtful, as the Yukon plays a peculiar rôle in maintaining and supplying a very necessary article of food for natives and whites, as well as for dogs. The latter are indispensible to winter travel except as reindeer may be used occasionally. A fish diet forms not only the cheapest food for dogs, but it is the best food for keeping them in good condition for winter service. There is a strong prejudice against the establishment of canneries on the lower Yukon, if such an undertaking should ever be considered feasible, as it would mean cutting off or greatly reducing the supply of salmon up the river, the result of which would be great privation and hardship to the people of that district. Therefore, under present conditions, the Yukon should remain undisturbed commercially in its production of salmon save for local needs.

HALIBUT FISHERY.

Halibut is second in commercial importance of the various food fishes obtained from the waters of Alaska, being exceeded in this respect only by salmon. The development of the halibut fishery has by no means reached its maximum, as there are fishing banks as yet but partly tried that give promise of a good yield, as soon as the industry expands sufficiently to warrant a more active fishery. These regions at present are regarded as rather remote and indefinite as to position and extent, but through the medium of explorations by the Bureau of Fisheries it is hoped that new and well-defined fishing areas may be developed. Good catches are the general rule on most of the grounds now fished, as is evidenced by the season of 1914, which was the most productive of any year in the history of the industry on the Pacific coast, but in order to avoid overfishing the present banks it is advisable to reach out for other grounds, thus keeping pace with any increase in market demands and at the same time allow the older banks to recuperate as may be necessary.

As for several years past, the halibut industry in Alaska in 1914 was centered chiefly at Ketchikan, where the cold-storage plant of the New England Fish Co., the largest of its kind in Alaska, is located. Other important centers of the industry were Sitka, where the Booth Fisheries Co. operated a cold-storage plant; Juneau, where a similar establishment was operated by the Juneau Cold Storage Co.; and Taku Harbor, where the Taku Canning & Cold Storage Co., in addition to its principal business of canning salmon, was engaged quite extensively in the freezing of halibut. The Columbia & Northern Fishing & Packing Co. also froze a smaller quantity of halibut at Wrangell. The Glacier Fisheries Co., which operated a floating cold-storage plant on *The Glory of the Seas* at Idaho Inlet in 1913, did not send the vessel north this year.

The methods of handling halibut at the cold-storage plants in Alaska are first-class in every respect. The fish are eviscerated aboard the vessels, and upon coming ashore they are washed and immediately placed in the sharp freezers, where they are allowed to remain about 24 hours at a temperature of from 10° to 20° F. The next step in the process is the glazing, which consists of dipping each fish four or five times in fresh water until it becomes entirely incased in a thin sheet of clear ice. The fish are then held in storage rooms at a temperature of about 28° F. until required for shipment. Prior to shipment the fins are trimmed off and a final immersion for additional glazing is given, after which each fish is wrapped in vegetable parchment paper, around which is an additional covering of smooth-finish manila paper. The fish are then packed in boxes lined with paper of about 375 pounds capacity, and shipment is made in cold-storage steamers to the railroad terminals for final distribution to the markets. Since the halibut banks of the Atlantic produce only about 15 per cent of the halibut consumed in the United States, the result is that most of the Pacific coast product is sent directly to the eastern distributing centers at Boston, New York, and other important centers. Notwithstanding the great distance of the Alaska halibut banks from the eastern markets, the painstaking care exercised in preparing and handling frozen halibut means a high-grade food product.

It is during the months of favorable weather, when fishing operations are extensively conducted, that the freezing of most of the halibut takes place. These fish are available for market purposes somewhat later on, when heavy weather greatly lessens the quantity of fresh halibut landed. At other times the markets are supplied by heavy shipments of fresh halibut packed in ice, and, as facilities are such that the fish are handled with dispatch and under very favorable conditions, they reach the markets in the East or elsewhere in excellent condition.

In proportion to the extent of operations, and taking into account the fact that much of the work is quite hazardous on account of heavy weather, the halibut industry this year has experienced but comparatively little in the way of disasters. This speaks well for the stanch and seaworthy character of the vessels employed and the skill of the persons engaged in the work. The modern high-class halibut vessel for deep-sea work on the Pacific coast is about 80 feet in length, schooner rigged, with a motor of about 100 horsepower, and has fuel tanks sufficient for several thousand miles, cruising under power alone. A vessel of this type generally carries 6 dories and a crew of 15 men, and is capable of handling a cargo of approximately 80,000 pounds of halibut.

The halibut schooner *Alice* (29 tons net) was wrecked January 31, 1914, on Kosciusko Island in southeast Alaska. There were 11 persons aboard at the time of the disaster, but no lives were lost. The halibut vessel *Montana* (33 tons net) was partly destroyed by fire May 2, 1914, at Redoubt Bay, near Sitka. The vessel sank in shallow water; and in the fall she was raised and taken to Puget Sound to be repaired and put in commission again.

There has been much apprehension upon the part of the business interests of southeast Alaska, particularly at Ketchikan, that the recent opening of the Grand Trunk Pacific Railway through to Prince Rupert, British Columbia, will mean a heavy loss of trade to Alaska because of the facilities thus afforded for quick delivery of fresh halibut to eastern markets. The landing of fish at Prince Rupert means going only 90 miles farther than Ketchikan and shipment to the Eastern States can be made in bond and delivery may be effected approximately two days earlier than by delivery through Ketchikan and reshipment on commercial steamers to Vancouver or Seattle, 600 miles or more distant. With the lessened expense for the shorter haul to Prince Rupert, it seems inevitable that as a natural result there will be some loss of trade in southeast Alaska. On the other hand, however, there will ensue at the same time certain benefits to the consumers of halibut in the United States, for delivery of this food product will be expedited considerably, and anything which makes it possible to put a perishable food commodity into the hands of the consumer with the least possible delay can not be disregarded, even though it may work some hardship upon certain communities that would benefit by other methods of handling. If Ketchikan could have the advantage of terminal rates for through shipments by way of the Grand Trunk Pacific, the problem now confronting the business interests of that community would be of easy solution. But looking at the matter impartially as a business proposition, it seems rather doubtful that an extension of such rates can be expected in the near future. If, however, Ketchikan and other towns in Alaska continue to offer facilities and inducements to the halibut fishermen as heretofore, it is not probable that the diversion of trade to Prince Rupert will assume the extensive or serious proportions predicted by some.

STATISTICAL SUMMARY.

The investment in the halibut fisheries of Alaska in 1914 amounted to $2,744,055, an increase of $384,030 over 1913. This increase was due chiefly to the addition of a number of new vessels of larger size than some of those heretofore engaged. These larger vessels have in certain instances supplanted several smaller boats, so that the total number of halibut craft is somewhat less in 1914 than in 1913. The number of persons engaged in 1914 was 1,406, as against 1,256 in 1913. There was also a corresponding increase in the product, which in 1914 totaled 14,807,797 pounds, valued at $762,757, as compared with 13,687,784 pounds, valued at $571,314, in 1913, an increase for 1914 of 1,120,013 pounds and $191,443 in value. The figures given in the following tables include all vessels fishing for Alaska establishments, as well as the vessels from Puget Sound operating in Alaska waters, with the exception that catches made in extraterritorial waters of Alaska landed directly at Puget Sound ports by the fishing vessels are not included.

INVESTMENT IN THE ALASKA HALIBUT FISHERIES IN 1914.

Items.	Number.	Value.
Fishing vessels, steamer and power	146	$1,644,700
Tonnage	4,123	
Outfit		625,100
Dories	497	25,250
Apparatus: Trawls and fishing gear		82,005
Shore and fixed property		367,000
Total		2,744,055

PERSONS ENGAGED IN THE ALASKA HALIBUT FISHERIES IN 1914.

Races.	Number.
Whites	1,386
Natives	20
Total	1,406

PRODUCTS OF THE ALASKA HALIBUT FISHERIES IN 1914.

Products.	Pounds.[a]	Value.
Halibut:		
Fresh	9,973,355	$537,485
Frozen	4,437,468	215,744
Dry salted	346,170	6,697
Fletched	50,804	2,831
Total	14,807,797	762,757

[a] Prepared weight.

COD FISHERY.

The cod fishery in Alaskan waters in 1914 was carried on more extensively and with better success than in 1913, when results were considered very good. The vessels fishing off shore did well and the shore stations made large catches, while good prices have been realized on the season's product, although the European situation complicated matters somewhat for a time. One new company, the Northern Codfish Co., with headquarters at Seattle, entered the field, and several of the older companies increased their facilities during the year.

VESSEL FISHERY.

The Alaska Codfish Co. suffered the loss of the schooner *W. H. Dimond* (376 tons), which was wrecked February 2, 1914, on Bird Island, of the Shumagin Group, and became a total loss. The vessel was en route from San Francisco with supplies for the company's shore stations in Alaska, and was to have returned with a cargo of codfish. No lives were lost. This was the second disaster suffered by the Alaska Codfish Co. within a year, as the schooner *John D. Spreckels* was sunk in a collision off the California coast the previous season while en route from Alaska with a cargo of cod. The company acquired the schooner *Allen A* (266 tons) to replace the *W. H. Dimond* as a run vessel for the shore stations. The schooner *Glendale* (281 tons) was also added to the company's fishing fleet. The *City of Papeete*, heretofore rigged as a brigantine, is now listed as a schooner.

The schooner *Fortuna* (138 tons), formerly in the service of the Blom Codfish Co. before that concern suspended operations two years ago, was sent north this year by the newly organized Northern Codfish Co., of Seattle. The fleet of the Pacific Coast Codfish Co. was increased by the addition of the schooner *Maid of Orleans* (171 tons), formerly operated by the Matheson Fisheries Co. The latter company replaced this vessel with the *Wawona*, a schooner of 413 tons. The Union Fish Co. sold the power schooner *Union Jack* (39 tons) for service in the south seas and replaced this vessel with the power schooner *Pirate*, of 30 tons. The company's schooner *Sequoia*, which has heretofore been employed as a run vessel, was used as a fishing vessel this year. The power schooner *Golden State* made several voyages during the year from San Francisco to Alaska in the capacity of tender for the company's shore stations. The *Golden State* is the largest motor-propelled vessel in the fishing industry on the Pacific coast.

Although a number of gales were experienced, only one fisherman was reported as drowned this year.

The following vessels were operated in connection with the cod fishery in 1914:

ALASKA COD FLEET, 1914.

Names.	Class.	Net tonnage.	Operators.
Azalea	Schooner	327	Matheson Fisheries Co., Anacortes, Wash.
Fanny Dutard	do	252	Do.
Wawona	do	413	Robinson Fisheries Co., Anacortes, Wash.
Alice	do	220	Do.
John A	do	235	Pacific Coast Codfish Co., Seattle, Wash.
Charles R. Wilson	do	328	Do.
Maid of Orleans	do	171	Do.
Fortuna	do	138	Northern Codfish Co., Seattle, Wash.
W. H. Dimond [a]	do	376	Alaska Codfish Co., San Francisco, Cal.
Glendale	do	281	Do.
Allen A [b]	do	266	Do.
City of Papeete [b]	do	370	Do.
Nonpareil	Power schooner	31	Do.
Ottilie Fjord	Schooner	247	Pacific States Trading Co., San Francisco, Cal.
Bertha Dolbeer [b]	do	230	Do.
Sequoia	do	324	Union Fish Co., San Francisco, Cal.
Vega	do	233	Do.
Galilee	do	328	Do.
Golden State [b]	Power schooner	223	Do.
Pirate	do	30	Do.
Union	do	9	Do.
Union Flag	do	7	Do.
Martha	Schooner	14	Do.

[a] Wrecked Feb. 2, 1914.

[b] Transporting vessels.

SHORE STATIONS.

Shore stations were situated as follows: Alaska Codfish Co.: Unga, Squaw Harbor, and Kelleys Rock, on Unga Island; Companys Harbor and Murphys Cove, on Sannak Island; and Dora Harbor, on Unimak Island. Pacific States Trading Co.: Northwest Harbor, Herendeen Island. Union Fish Co.: Pirate Cove, Popof Island; Northwest Harbor, Herendeen Island; Pavlof Harbor and Johnson Harbor on Sannak Island; Unga, on Unga Island; and Dora Harbor, on Unimak Island. Also smaller independent shore stations were reported as operated on Unga Island by John H. Nelson, at Squaw Harbor, and by R. H. Johnson, A. Grosvold, and A. Komedal.

STATISTICAL SUMMARY.

The investment in the Alaska cod fishery in 1914, including both offshore vessels and shore stations, was $623,921, as compared with $581,107 in 1913. There was also an increase in the number of persons engaged, there being 677 employed in 1914 as against 531 in 1913. This is a gain of 146 persons for 1914. Figures for the shore stations in the States are not included.

The products of the Alaska cod fishery this year aggregated 15,045,378 pounds, valued at $438,208. The figures for 1913 were 11,916,900 pounds, valued at $357,711, thus showing an increase in quantity for 1914 of 3,128,478 pounds and an increase of $80,497 in value.

INVESTMENT IN THE COD FISHERY IN ALASKA IN 1914.

Items.	Number.	Value.	Items.	Number.	Value.
Vessels:			Apparatus:		
Power vessels	5	$81,500	Hand lines	2,587	$1,857
Tonnage	314	....	Gill nets	1	40
Launches under 5 tons	4	3,170	Cash capital	....	229,000
Sailing vessels	16	178,261	Value shore stations	....	116,203
Tonnage	4,263	....			
Boats, row	423	13,890	Total	....	623,921

PERSONS ENGAGED IN THE ALASKA COD FISHERY IN 1914.

Occupations and races.	Number.	Occupations and races.	Number.
Fishermen:		Transporters:	
Whites	511	Whites	55
Natives	5		
Total	516	Grand total	677
Shoresmen:			
Whites	103		
Japanese	3		
Total	106		

PRODUCTS OF ALASKA COD FISHERY IN 1914.

Products.	Pounds.	Value.
Vessel catch:		
Salted cod	9,407,178	$278,898
Tongues	31,800	2,200
Total	9,438,978	281,098
Shore-station catch:		
Salted cod	5,594,000	156,490
Tongues	12,400	620
Total	5,606,400	157,110
Total:		
Salted cod	15,001,178	435,388
Tongues	44,200	2,820
	15,045,378	438,208

HERRING FISHERY.

Herring operations in Alaska are confined more particularly to the colder months of the year, although there is more or less activity at all times when herring are available for bait in the halibut fishery. It has long been recognized that fresh herring are superior to pickled herring for bait; therefore every effort is made by the halibut fishermen to obtain fresh herring. In order to cover those periods when the schools of herring are not easily located, it is necessary to resort either to pickled herring or to frozen herring. As a matter of fact, frozen herring is almost as good as fresh herring for bait purposes.

Throughout the fall of 1914 conditions in southeast Alaska were rather unusual, as herring were so scarce that companies operating halibut vessels had to import herring for bait from British Columbia to enable them to operate their vessels. Most of the herring imported for bait was frozen, as the scarcity of herring affected British Columbia as well. It is true that only a comparatively small quantity was imported, as nearly all fishermen entertained the idea that herring would make their appearance in the waters of southeast Alaska late in the fall or early in the winter. A heavy run of herring finally appeared along in December, in Tongass Narrows and elsewhere in southeast Alaska, and from that date until the end of the year the herring fishermen were quite busy, and the cold-storage establishments were engaged in freezing herring almost to the capacity of their plants, notwithstanding the early scarcity. So numerous were herring in Tongass Narrows at the end of the year that on several occasions seiners made one end of their net fast to the wharf of the New England Fish Co. and made a haul along the face of the dock. The herring thus obtained were in excellent condition for freezing and were of the right size to make first-class bait for halibut fishermen. This is cited to show that while there may sometimes be a temporary absence of herring in a given region, which causes general complaint on the part of the fishermen, almost invariably enormous runs develop sooner or later. Notwithstanding that herring suitable for halibut bait are but rarely taken in appreciable numbers in Tongass Narrows, it is recorded that at one time in December, 1914, more than 2,000 barrels were taken by four seines in this restricted area.

The operations of the Alaska Oil & Guano Co. were continued at Killisnoo this season as during past years. The season of 1914, however, was rather unsatisfactory on account of inclement weather. It is very difficult to locate schools of herring when the surface of the water is agitated or disturbed by the wind. Operations were discontinued the last of September, about a month earlier than usual, as it did not seem profitable under the circumstances to take a chance on uncertain weather conditions through the month of October. It is noteworthy of mention that quite a number of halibut steamers obtained bait at Killisnoo this season. Heretofore the product of this establishment has been confined almost wholly to oil and fertilizer. The growing use of fish meal as the base of a highly desirable form of poultry food, is well set forth by the fact that this year at Killisnoo upward of 200 tons of the fertilizer product were sold for use as poultry food. When fish meal is used as poultry food it is necessary that the oil content be reduced to the lowest possible minimum.

Considerable activity was manifested again this year in the preparation of pickled herring for food, the industry centering at Petersburg. The herring of Alaska are in every way the equal of those so prepared in Norway or other important centers of the industry. At times in the past, however, there has not been sufficient care exercised in packing herring in Alaska. Fortunately, however, the fishermen and packers are coming to realize this fact, and shipments within the last year or two from Alaska have been of a uniformly high grade. The herring are captured chiefly by means of small-meshed purse seines, which means that all sizes of the fish are landed. This necessitates considerable labor in selecting the larger fish for food. The smaller fish are available for bait in the halibut fishery, although at times there has been much waste of the smaller fish after the larger ones have been selected for food purposes. This practice is contrary to the provisions of the wanton-waste feature of the fisheries law, and its further continuance will result in prosecutions of those who engage in the practice. If gill nets were used more extensively in the capture of herring intended for pickling purposes, there would be much less likelihood of wasting any fish, as by the use of a proper size of mesh the smaller herring would be enabled to pass through the nets. This form of gear would also save labor in culling out the larger fish, which is necessary in handling the catch made in purse seines. It is realized, however, that where operations are conducted on an extensive scale the use of purse seines is preferable from the viewpoint of the fisherman and packer as a means for the capture of herring.

The herring fishery of Alaska has been by no means developed to anything like its maximum productivity, and it is believed that this industry offers a profitable field to those who will offer for sale a carefully selected and high grade of herring. It seems unnecessary that the United States should import large quantities of herring from Norway or Scotland when the possibilities of this industry in Alaska and other parts of the country are of great extent. Instead of having European herring come to this country, it would seem that an export trade might be built up, as the enormous yield of herring heretofore available from the North Sea has been greatly curtailed on account of the present war.

STATISTICAL SUMMARY.

The figures for the herring fishery in Alaska in 1914 show a decline in the industry as compared with 1913. The total investment for

1914 was $203,045 as against $261,480 for 1913, a falling off this year of $58,435. The number of persons engaged in 1914 was 144 as compared with 200 in 1913. The value of the products in 1914 was $123,217 as against $191,105 in 1913, a reduction of $67,888.

INVESTMENT IN THE HERRING FISHERY IN ALASKA IN 1914.

Items.	Number.	Value.	Items.	Number.	Value.
Vessels:			Apparatus:		
Steamers and launches	5	$17,500	Purse seines	11	$12,600
Tonnage	160		Gill nets	1	70
Launches under 5 tons	2	3,000	Cash capital		102,250
Sailing	1	7,000	Shore and accessory property		56,500
Tonnage	12				
Boats, row	30	1,725			
Lighters and scows	4	1,400	Total		203,045
Pile drivers	2	1,000			

PERSONS ENGAGED IN THE ALASKA HERRING FISHERY IN 1914.

Occupations and races.	Number.
Fishermen: Whites	75
Shoresmen:	
Whites	47
Natives	12
Japanese	10
Total	69
Grand total	144

PRODUCTS OF ALASKA HERRING FISHERY IN 1914.

Products.		Quantity.	Value.
Herring:			
Fresh, for bait	pounds	3,531,100	$22,334
Frozen, for bait	do	1,336,680	6,241
Pickled, for food[a]	barrels	1,955	20,595
Pickled, for bait	do	2,450	4,800
Dry-salted, for food	pounds	626,000	6,640
Fertilizer	tons	963	24,075
Oil	gallons	192,662	38,532
Total			123,217

[a] Includes 520 barrels pickled for food, valued at $4,600, from central Alaska. All other products listed are from southeast Alaska.

WHALE FISHERY.

SHORE-STATION OPERATIONS.

The whaling industry in Alaska in 1914 was conducted on a more extensive scale than during the previous year, when only one shore station was in operation. Two plants were operated in 1914, one by the United States Whaling Co., at Port Armstrong, in southeast Alaska, and the other by the Pacific Sea Products Co. at Akutan, in western Alaska. The latter company was newly organized for work this season and took over the plant and equipment of the Alaska Whaling Co., which concern built and operated the station at Akutan in 1912, but on account of unprofitable returns did not operate in 1913. The Pacific Sea Products Co. made some additions to the plant and engaged extensively in the manufacture of fertilizer from the flesh of the whales.

Five steamers were used this year for killing whales. Two of these, the *Unimak* and *Kodiak* (99 tons each), were operated by the Pacific Sea Products Co. and three, the *Star I* (133 tons), and the *Star II*, and *Star III* (97 tons each) were operated by the United States Whaling Co. These vessels are of the type common to modern shore whaling operations, each having at the bow a 3¼-inch muzzle-loading gun. Attached to the explosive missile which is hurled into the whale, usually from a distance of about 120 feet, is a heavy line leading back to a steam winch mounted on the forward deck of the vessel. This winch is used to keep a strain on the line attached to the whale, paying it out or hauling it in as may be necessary until finally the whale is brought alongside. The animal is then pumped up with air to prevent sinking, and towed to the shore station. If more whales are in sight, a marker is placed on the one already taken, and it is turned adrift temporarily while the pursuit of others is continued. Special efforts are always put forth to capture sperm whales, as this species is much more valuable than the others found off the Pacific shores of Alaska. The valuable bowhead whale is taken only in more northern waters. Sperms are especially sought because of the rich grade of oil or spermaceti, which comes from a cavity in the head. A single sperm whale will sometimes produce as many as 20 barrels of this high-grade and valuable product. This is in addition to the oil and fertilizer from the remainder of the animal, which is available from sperms as well as from the other species handled.

Upon arrival at the station, the whales are hauled out on a platform and the blubber is stripped off by means of a winch. The blubber is cut up and cooked in open steam retorts to remove the oil. The carcass of the animal is then cut up and the meat and bones are cooked separately in steam retorts under a pressure of about 65 pounds for periods of from 10 to 24 hours. The oil resulting from this process is drawn off and the residue is passed through driers for conversion into fertilizer.

Whale oil of the following grades is produced: Nos. 0 and 1 from the blubber; no. 2 from the bones; and nos. 3 and 4 from the meat. The best grade of oil comes from sperm whales, and at present prices a 50-gallon barrel sells for about $20. The next grade sells for about $15 a barrel, and for grades nos. 2, 3, and 4 the price is about $12 per barrel. The United States Whaling Co. reports that after the oil has been boiled out of the meat and bones the following fertilizer and other products are prepared: Cattle food, made from clean meat; guano, from meat and bones mixed; and bone meal, from pure bones. The price obtained for the cattle food is about $40 a ton, for the guano $27 a ton, and for the bone meal grade $20 a ton.

OFFSHORE WHALING FLEET.

The steamer *Herman* (229 tons) cleared from San Francisco on March 24, 1914, for a whaling voyage and returned to that port on November 7. There was a take of 10,000 pounds of whalebone as a result of this cruise, and certain skins were obtained in trade with natives at Herschel Island. The *Herman* made a catch of six bowhead whales.

The brigantine *Jeanette* (217 tons) cleared from San Francisco on May 27, 1914, for Point Barrow, and returned from there on October 3 with whale products amounting to 2,461 pounds of bone.

The power schooner *Polar Bear* (55 tons), operated by Louis Lane, of Seattle, returned to that place on October 25, after having been left in the ice throughout the previous winter at a place near Point Humphries and about 12 miles west of the steamer *Belvedere.* A catch of 10 bowheads was made in the Arctic this season by the *Polar Bear*, and a take of 17,000 pounds of bone resulted.

The steamer *Belvedere* (339 tons) returned to Seattle on November 2, 1914. A total of five bowhead whales were taken, and 8,000 pounds of bone represented the season's product. This was valued at 75 cents per pound, or a total of $6,000. No oil was taken, the blubber from the whales as well as the carcasses being given to natives of Alaska for food. The *Belvedere* went north from San Francisco in March, 1913, and wintered in the ice near Point Humphries.

The bark *Gay Head* (252 tons), which left San Francisco in October, 1913, on a voyage to southern whaling grounds, worked northward into Alaskan waters in the spring of 1914. While cruising along that coast the vessel stranded in heavy weather on June 27, 1914, at Chignik Bay and became a total loss. There were 31 persons aboard at the time, but all got ashore safely and made their way to a near-by cannery. There was quite a loss of sperm oil which had been taken on the cruise in the south seas. The *Gay Head* was built in Massachusetts in 1877 and sailed upon many whaling voyages.

The steamer *Karluk* (247 tons), for years identified with the San Francisco whaling fleet, went north with the Stefansson Arctic expedition in the spring of 1913. Although official advices have not as yet been received, it appears that this steamer was crushed in the ice near Herald Island, 80 miles from Wrangell Island, Alaska, in December, 1913, or in January, 1914. No particulars regarding the vessel are available at the present time.

The steamers *Beluga* (409 tons), *Bowhead* (243 tons), *Narwhal* (389 tons), and *Thrasher* (502 tons), did not engage in whaling this year, but were laid up in Oakland Creek.

STATISTICAL SUMMARY.

The total investment in the shore whaling industry in Alaska this year was $1,456,649, as compared with $891,780 in 1913, and the number of persons employed in 1914 was 225, as against 99 in 1913. The value of the products in 1914 also shows a notable gain, being $291,099 as compared with $157,550 in 1913. The total number of whales taken by the shore stations in 1914 was 482, while in 1913 the catch was 186 whales.

WHALES TAKEN IN SHORE OPERATIONS IN 1914.

Species.	Number.
Sperm	43
Sulphur-bottom	35
Finback	259
Humpback	131
Others	14
Total	482

INVESTMENT IN SHORE WHALE FISHERY IN ALASKA IN 1914.

Items.	Number.	Value.	Items.	Number.	Value.
Vessels:			Lighters and scows	3	$350
Steamers	5	$266,000	Pile drivers	2	750
Tonnage	525		Value of plants		612,900
Barges	1	10,000	Cash capital		475,000
Tonnage	1,100		Wages paid		91,119
Launches under 5 tons	1	435			
Boats, row	6	95	Total		1,456,649

PERSONS ENGAGED IN SHORE WHALE FISHERY IN ALASKA IN 1914.

Races.	Number.
Whites	134
Japanese	77
Natives	14
Total	225

PRODUCTS OF ALASKA SHORE WHALING OPERATIONS IN 1914.

Products.	Quantity.	Value.
Whale oil ... gallons	632,400	$182,690
Sperm oil ... do	162,750	66,727
Fertilizer, meat ... tons	702	31,256
Fertilizer, bone ... do	86	2,236
Fertilizer, meat and bone combined ... do	273	8,190
Total		291,099

In addition to the foregoing, the offshore whaling fleet in Arctic waters took 21 bowhead whales and obtained approximately 35,000 pounds of bone, valued at $26,250. These figures are included in the general summary of Alaska products.

FERTILIZER AND OILS.

The manufacture of fertilizer and oil from fisheries products in Alaska was conducted along more extensive lines this year than perhaps ever before. The chief impetus to the industry resulted from the erection of a large plant by the Fish Canners By-Products Co. (Ltd.), at Ward Cove, near Ketchikan, Alaska. The principal work of this plant is the utilization of fish offal in the manufacture of oils, meal, fertilizer, glue, and similar products. Active construction of the plant began April 10 and operations in all departments were under way by August 10. The main factory building is 150 feet long by 30 feet deep, and various auxiliary buildings of smaller size have been provided. The oil-storage capacity consists of six 30,000-gallon tanks. A complete outfit of machinery designed to the needs of the plant was installed; this consists of boilers, engines, hydraulic presses, vacuum driers, oil cookers, fillers, metal screens, and automatic bagging and weighing machines. The floating equipment consists of six 30-ton scows and three power boats designed especially for the collection of fish offal from canneries.

During the past season, the company collected the offal from eight canneries within a distance of 50 miles from Ketchikan, and worked up a total of about 1,400 tons of this material. At each cannery special conveyors were constructed at the reduction plant's expense, and the material was conveyed into storage tanks. The collection of the offal was made daily. Contracts covering varying periods of time were entered into with the canneries for the disposal of the offal.

Upon arrival at the reduction works the material is discharged from the boats and scows by means of a movable bucket elevator having a capacity for mechanically discharging 35 tons per hour and delivering same into storage compartments. From these compartments the material is elevated to the top of the factory and distributed into the cooker reserve tanks; then it is delivered by gravity to the cookers, where the substance is cooked by steam. From the cookers the mass, after all the liquids have been drained, is discharged by gravity to the press storage reserve tanks and thence by gravity to the press cars. The presses are operated at about 7,000 pounds to the square inch and the material is then passed to the driers. It is next screened and ground until the desired fineness is obtained and is cooled, following which it is weighed by an automatic machine and made ready for shipment. The liquids coming from the cooker and presses are all separately treated in the oil-refining process, the oil and water first being separated in independent tanks, following which the oil is boiled, filtered, bleached, deodorized, and finally pumped into storage tanks, from which it is drawn off in drums for shipment. Fish offal that contains more than a certain percentage of acid is not used in the manufacture of meal or oil. Next season it is anticipated that all the tankage after being separated from the fatty liquids will be evaporated and processed for its glue and other values.

The plant of the By-Products Co. was completed so late in the season that operations this year were of a limited character. Next year it is contempleted to expand the work greatly.

In the season of 1913, the North Pacific Trading & Packing Co. established in conjunction with its cannery at Klawak a plant for the manufacture of fertilizer and oil from the waste material in the process of canning salmon. The outfit consisted of conveyers, cookers, presses, pumps, settling tanks, and driers, and as a result of the season's experimental operations 6 tons of fertilizer and 500 gallons of fish oil were prepared. In 1914 the work was prosecuted more vigorously, and resulted in the preparation of 38 tons of fertilizer, worth $1,140, and 1,050 gallons of oil, valued at $210. Practically all of the gurry from the fish house was used. The management states that it is quite well pleased with the results of operations this year, and intends to take up the work again next season.

The operations of W. H. Royden, of Petersburg, on the motor scow *Elliott* (43 tons) included the preparation of 10 barrels of shark oil, valued at $120.

STATISTICAL SUMMARY.

Statistics for the production of oil and fertilizer other than in the whaling and herring industries are shown in the following table. Figures for whaling and herring products appear elsewhere in this report.

INVESTMENT IN BY-PRODUCTS INDUSTRY IN ALASKA IN 1914.

Items.	Number.	Value.	Items	Number.	Value.
Vessels:			Vessels—Continued.		
Boats, power	4	$20,000	Houseboats	1	$450
Tonnage	93		Plants operated	3	87,087
Launches under 5 tons	2	650	Wages paid		5,640
Boats, row	6	430			
Lighters and scows	6	2,350	Total		116,607

OUTPUT IN BY-PRODUCTS INDUSTRY IN ALASKA IN 1914.

Items.	Quantity.	Value.
Oil ... gallons	4,850	$1,188
Fertilizer ... tons	38	1,140
Edible fish meal ... do	116	3,786
Total		6,114

The number of persons engaged was 32, all whites, of whom 27 were shoresmen and 5 were transporters.

MINOR FISHERIES.

TROUT.

For a number of years considerable misapprehension existed as to the propriety of shipping Dolly Varden trout from Alaska into the State of Washington, in consequence of which but little interest was manifest in developing this phase of the fishery. Last year, definite announcement was made by State Fish Commissioner Darwin that there was no prohibition upon the commercial utilization in Washington of Dolly Varden trout shipped from Alaska. This no doubt had much to do with stimulating shipments of this species of fish from Alaska in 1914, as there was a great increase over the previous year. Shipments occurred chiefly from Ketchikan and Petersburg, and were heaviest during the month of May.

The further development of this industry should be encouraged, as the waters of Alaska abound with Dolly Varden trout, and their utilization will be beneficial to the salmon industry, as it is well known that the Dolly Varden are very destructive to salmon eggs and young salmon.

At Petersburg the Pacific Coast & Norway Packing Co. canned 16 cases of steelhead trout. The flesh of the steelhead is rather too light in color to make it attractive for canning, although the quality of the product is first-class. Moreover, the steelhead is regarded as too valuable for freezing and for sale in a fresh state, to warrant any extensive effort to market it as a canned product. It is particularly in a frozen condition that the steelhead finds greatest favor with the fishing interests, as it seems to be unusually well adapted to this mode of preparation. The catch of steelhead in Alaskan waters is comparatively limited. At Ketchikan in 1914 there were frozen 18,483 pounds of steelhead, which shows a substantial increase over the 5,093 pounds frozen the previous year.

In central Alaska, the W. J. Erskine Co. put up 22 barrels of pickled Dolly Varden trout at Eagle Harbor on Kodiak Island. When prepared in this manner their value is about the same as that of pickled sockeye salmon.

In addition to its pack of Coho salmon, the Midnight Sun Packing Co. put up 125 cases of Dolly Varden trout. This cannery is located on Kotzebue Sound near the mouth of the Noatak River, and is the northernmost cannery in Alaska. It was established in 1912 primarily with a view to the canning of trout. The season is short, active operations being chiefly in August. The fish were taken by means of two small traps.

PRODUCTS OF THE ALASKA TROUT FISHERY IN 1914.

Sections and species.	Fresh.		Frozen.		Canned.		Pickled.	
	Pounds.	*Value.*	*Pounds.*	*Value.*	*Cases.*[a]	*Value.*	*Barrels.*	*Value.*
Southeast Alaska:								
Dolly Varden	62,555	$3,753						
Steelhead	4,400	264	18,483	$917	16	$48		
Total	66,955	4,017	18,483	917	16	48		
Central Alaska: Dolly Varden							22	$214
Western Alaska: Dolly Varden					125	562		
Grand total	66,955	4,017	18,483	917	141	610	22	214

[a] Each case contains forty-eight 1-pound tall cans.

BLACK COD.

The popularity of the black cod (*Anoplopoma fimbria*) is becoming more pronounced each year. Contrary to the inference that might be derived from its common name, this fish is quite different from the true cod which has so long been marketed as a salt-fish product. The black cod is of the same general size, and other than its darker color is of similar appearance to the ordinary cod. Its flesh, however, is much richer in oils; in fact, the black cod is sometimes considered as rather too oily for table use. Black cod are usually taken on halibut trawls in water of 300 fathoms or more in depth; this fish does not frequent the shoaler waters in which halibut are often caught. Until an active market developed for black cod about three or four years ago, it was hardly thought worth while by the fishermen to pay much attention to them, and they were often thrown away to make room for the halibut.

The black cod has been eaten locally in Alaska to a certain extent for many years, but shipments to Puget Sound were infrequent and limited. In recent years Seattle restaurants have featured barbecued black cod, and as a result this article of food is becoming much better known on the Pacific coast and a real demand for it has been established. In preparing barbecued black cod the backs of the fish are kippered or smoked after being lightly salted. When served with drawn butter it makes a very rich and toothsome article of food.

Salt and frozen black cod are shipped from Alaska as well as those in a fresh condition. When the kippered backs are prepared it is generally the practice to salt down the remaining edible portions of the fish.

SHIPMENT OF BLACK COD FROM ALASKA WATERS IN 1914.

Products.	Pounds.	Value.
Fresh	40,560	$2,353
Frozen	40,013	1,900
Pickled	7,000	490
Total	87,573	4,743

CLAMS.

At Petersburg W. H. Royden, who operates the motor scow *Elliott*, prepared 60 cases of 1-pound cans of clams valued at $300. This is an industry which merits much expansion in Alaska, as the quality of the clams is excellent and the supply is good in a number of sections. Formerly there was quite a pack of clams and clam juice in Alaska, particularly at Klawak, but of recent years little or no attention has been paid to this business. Clams, however, have in various places formed an important item of the local food supply.

FUR-SEAL SERVICE.[a]

GOVERNMENT EMPLOYEES ON PRIBILOF ISLANDS.

The statutory officers and employees on the Pribilof Islands during the calendar year 1914 were as follows:

St. Paul Island: Agent and caretaker, Philip R. E. Hatton, succeeded by Harry C. Fassett; storekeeper, Leonard M. Tongue, succeeded by E. M. Ball; school-teachers, Mr. and Mrs. Alvin G. Whitney, succeeded by Mr. and Mrs. G. Dallas Hanna; physician, Henry Esmond, succeeded by William B. Hunter.

St. George Island: Agent and caretaker, A. H. Proctor; school-teacher, G. Dallas Hanna, succeeded by George Haley; physician, William M. Murphy.

The appropriations also provided for janitor service, for which natives of the islands were employed.

As the result of voluntary resignations and of an investigation of the general conditions on the islands made by the department, through a board constituted for the purpose, there was a considerable reorganization of the personnel and methods.

SPECIAL INVESTIGATIONS.

In the course of Deputy Commissioner Jones's investigations of the various phases of the Bureau's work in Alaska, a comprehensive report of which was published in January, 1915, considerable attention was given to administrative matters on the Pribilof Islands. Improvements in methods of work were inaugurated and recommendations were made for future changes of a more general nature.

It being deemed that an examination and report of the precise condition of the fur-seal herd would be of service in indicating the best policy to be pursued by the Government in the future management of the herd, the Department took steps early in the year to secure the services of three qualified persons who might be sent to the Pribilofs for this purpose. The persons selected were Dr. George H. Parker, of Harvard University, Cambridge, Mass.; Mr. Wilfred H. Osgood, of the Field Museum of Natural History, Chicago, Ill.; and Mr. Edward A. Preble, of the Bureau of Biological Survey, Department of Agriculture. They left Seattle, Wash., on the revenue cutter *McCulloch* on June 11 and arrived at St. Paul Island on June 21.

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[a] The manuscript reports of H. C. Fassett and others have been drawn on freely in the preparation of this section.

Dr. Parker remained on the islands until August 6 and Messrs. Osgood and Preble until August 30.

Their report was submitted to the Bureau on January 23, 1915. In addition to taking a census of the seal herd, an exhaustive study was made of the different elements composing the herd, and recommendations were submitted in regard to the management of the herd and its products both from biological and economic standpoints. Attention also was given to the other primary factors affecting the administration of the islands, including the native inhabitants, the foxes, reindeer, sea lions, birds, and fishes.

The Canadian and Japanese Governments also sent representatives to the islands. The Canadian Government was represented by Mr. James M. Macoun and Mr. B. W. Harmon, and the Japanese Government by Dr. T. Kitahara.

PATROL FOR THE PREVENTION OF PELAGIC SEALING.

The law of August 24, 1912, provides it shall be the duty of the President to cause a guard or patrol to be maintained in the waters frequented by the seal herd or herds and sea otter, in the protection of which the United States is especially interested, to be composed of naval or other public vessels of the United States designated by him for such purpose.

Since the enactment of this law the duty of maintaining the required patrol has been assigned exclusively to vessels of the Revenue-Cutter Service.[a] For the season of 1914 the vessels *Tahoma*, *Manning*, and *Unalga* were selected to compose the Bering Sea fleet for this duty. Unalaska, Alaska, was designated as headquarters of the fleet. The commanding officer of each vessel reported to the commanding officer of the fleet in April and the patrol was carried on in an efficient manner throughout the season. In addition to the regular patrol work for the protection of the fur seal and the sea otter, the fleet was to enforce, as far as practicable, the laws and regulations for the protection of the fisheries and the fur-bearing animals of Alaska and to perform other duties properly pertaining to the work of the Revenue-Cutter Service.[a] The *McCulloch* was also detailed to the fleet for a short period, but did not perform any duty directly connected therewith. She did, however, transport from Seattle to the Pribilof Islands the scientific assistants for special study of the fur-seal herds. The *Bear*, while not a part of the fleet, transported on one occasion mail and supplies from Unalaska to the Pribilofs.

Throughout the season the various vessels of the Revenue-Cutter Service[a] rendered invaluable service to the Department in the transportation of mail, supplies, and persons and of fur-seal and fox skins from the islands to Seattle.

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[a] The Revenue-Cutter Service was combined with the Life-Saving Service and name changed to Coast Guard by act of Jan. 28, 1915.

PELAGIC SEALING.

Reports are received from time to time in regard to probable prospective plans to take seals illegally. The clues furnished are always followed up assiduously, but so far with negative results. It is safe to state that illegal pelagic sealing at the expense of the Pribilof Islands herd has entirely ceased.

The North Pacific Sealing Convention of July 7, 1911, allows, under certain conditions, Indians, Aleuts, or other aborigines dwelling on the coasts of America to take fur seals. The act of Congress approved August 24, 1912, giving effect to that convention, restricted the privileges allowed by the convention to the extent of prohibiting the killing of fur seals within the 3-mile limit in the waters of Alaska.

So far as the Bureau is informed, no persons in Alaska availed themselves of their privileges in 1914. In April, 1914, Indians under the jurisdiction of the Neah Bay, Wash., superintendency took, by means of spears, 14 fur seals, of which 12 were females.

RADIO SERVICE.

The radio stations maintained by the Navy Department on both St. Paul and St George Islands continued to render invaluable service to the Bureau of Fisheries. For several months during each winter season the islands are without other means of communication with each other or with the outside world. For a period of several months, beginning in October, 1913, the radio station on St. George Island was operated by Mr. G. Dallas Hanna, the Bureau's schoolteacher on the island.

PURCHASE OF ANNUAL SUPPLIES.

Early in the year preliminary arrangements were undertaken at Seattle for the annual purchase of general supplies for use in connection with the fur-seal service at the Pribilof Islands. For transporting these to the islands the steamer *Melville Dollar* was chartered. The purchasing of the larger portion was consummated in June, and dispatched from Seattle the latter part of that month. Additional supplies were later obtained at Unalaska and Seattle. The aggregate cost of the supplies purchased for the islands in the calendar year 1914 was approximately $40,000.

CENSUS OF THE FUR-SEAL HERD.

As in preceding years, a census of the fur seals present at the Pribilof Islands was taken in the summer of 1914. The method of taking the census is fully discussed in the report submitted by the investigators selected by the Department to make special studies of the fur-seal herd in 1914.

The following table, taken from their report, shows in condensed form the components of the herd in 1912, 1913, and 1914, the three years which have ensued since the cessation of pelagic sealing:

General Comparison of Recent Censuses of the Seal Herd.

Class of seals.	1912	1913	1914
Breeding bulls	1,358	1,403	1,559
Breeding cows	81,984	92,269	93,250
Idle bulls	113	105	172
Young bulls (chiefly 5-year-olds)	199	259	1,658
Four-year-old bachelors	100	2,000	9,939
Three-year-old bachelors	2,000	10,000	13,880
Two-year-old bachelors	11,000	15,000	17,422
Yearling bachelors	13,000	20,000	23,068
Two-year-old cows	11,000	15,000	17,422
Yearling cows	13,000	20,000	23,067
Pups	81,984	92,269	93,250
Total	215,738	268,305	294,687

KILLING OF SEALS.

The effect of provisions of existing law was such that the killing of seals on the Pribilof Islands during the calendar year 1914 was necessarily restricted to such numbers of male seals as were needed to supply food for the native inhabitants. The number of seals necessary to supply food for these people being left to the discretion of the Department, the Secretary in 1913 fixed upon 3,500 as the maximum number which might properly be killed for that purpose during the year.

In 1914, as a result of the findings of the special investigators who were sent to the islands, and upon their recommendation, 4,500 was decided upon as the number which might be killed annually.

During the calendar year 1914 there were killed on St. Paul Island 1,764 seals and on St. George Island 971. In 1913, 1,791 were killed on St. Paul Island and 615 on St. George Island.

Record of Fur Seals Killed on St. Paul Island, Alaska, During the Year ended Dec. 31, 1913.

Date.	Rookery.	Number.	Date.	Rookery.	Number.
1913.			1913.		
May 14	Northeast Point	12	Aug. 16	Reef	167
21	Sivutch (Sea Lion Rock)	132	24	....do	5
21	Northeast Point	5	24	Northeast Point	5
24	....do	19	Oct. 25	Polovina	2
June 3	....do	10	Nov. 4	Northeast Point	55
9	Reef	154	4	....do	9
23	....do	335	6	Zapadni	1
July 3	....do	44	10	Reef	107
7	....do	414	23	Northeast Point	10
8	Northeast Point	15	23	Zapadni	1
22	....do	3	Dec. 30	Sivutch (Sea Lion Rock)	130
Aug. 1	Reef	153			
6	Northeast Point	3		Total	1,791

RECORD OF FUR SEALS KILLED ON ST. PAUL ISLAND, ALASKA, DURING THE YEAR ENDED DEC. 31, 1914.

Date.	Rookery.	Number.	Date.	Rookery.	Number.
1914.			1914.		
May 17	Northeast Point	6	Aug. 18	Reef	15
24	do	6	Sept. 7	Northeast Point	2
30	Reef	115	20	do	2
June 10	Northeast Point	6	Oct. 6	Reef (entire peninsula, including Gorbatch, Reef, and Ardiguen)	135
12	Reef	104	24	Tolstoi	208
15	Northeast Point	6	26	Northeast Point	5
July 1	Reef	216	28	Tolstoi (found dead after drive of Oct. 24)	1
7	Northeast Point	6	Nov. 14	Northeast Point (Vostochni)	52
21	Gorbatch	67	17	Tolstoi	35
23	Northeast Point	2	18	Zapadni	1
Aug. 1	Gorbatch	99	Dec. 14	Northeast Point	2
2	Northeast Point	1		Total	1,764
6	Reef	126			
8	do	447			
10	Tolstoi	96			
17	Northeast Point	3			

RECORD OF FUR SEALS KILLED ON ST. GEORGE ISLAND, ALASKA, DURING THE YEAR ENDED DEC. 31, 1913.

Date.	Rookery.	Number.	Date.	Rookery.	Number.
1913.			1913.		
June 10	East	59	Oct. 21	North	36
17	Zapadni	2	21		2
23	North	38	24	East	40
29	Zapadni	2	25	Zapadni	1
July 3	North	41	Nov. 1	do	1
5	Zapadni	1	2	North	20
9	do	2	3	East	27
20	East	85	5	Staraya Artel	62
Aug. 5	Zapadni	2	5		1
14	North	20	6	Zapadni	2
15	East	26	10	North	76
16	Staraya Artel	45	25	North and Staraya Artel	18
16	Zapadni	1		Total	615
16		2			

RECORD OF FUR SEALS KILLED ON ST. GEORGE ISLAND, ALASKA, DURING THE YEAR ENDED DEC. 31, 1914.

Date.	Rookery.	Number.	Date.	Rookery.	Number.
1914.			1914.		
June 5	East	37	Aug. 8	Zapadni	2
12	North	30	10	North	89
13	Zapadni	2	10	Zapadni	1
19	Staraya Artel	89	16	do	1
20	Zapadni	2	Oct. 20	East	33
29	East	51	29	North	54
July 4	Zapadni	2	Nov. 7	East	55
9	North	47	8	North	17
10	Zapadni	2	17	Staraya Artel	24
16	Staraya Artel	43	23	North	9
25	North	102	24	East	38
31	do	124	27	Staraya Artel	35
Aug. 3	East	51			
7	Staraya Artel	31		Total	971

DISPOSITION OF SKINS SHIPPED FROM PRIBILOF ISLANDS IN 1914.

The annual shipment of fur-seal skins and fox skins was made in October; it consisted of 2,884 sealskins, 256 blue fox skins, and 25 white fox skins. The skins were transported from the Pribilofs to Seattle, Wash., on the revenue cutter *Manning*. At Seattle they were delivered to an agent of the Bureau who promptly forwarded them via the Northern Pacific and the Chicago, Burlington & Quincy Railroads to St. Louis, Mo., where they were received by Messrs. Funsten Bros. & Co. as selling agents for the Department. Owing to the continued depression in the fur trade it was deemed advisable to postpone the sale until more favorable conditions might obtain, and at the end of the year the skins remained unsold with this firm in St. Louis.

The act of Congress approved August 24, 1912, giving effect to the North Pacific Sealing Convention of July 7, 1911, provided that the fur-seal skins taken on the Pribilof Islands should be annually sold by the Government. Inasmuch as it was deemed that a compulsory sale of the skins shipped in 1914 would for the reason previously stated result in a loss of revenue to the Government, Congress was asked to authorize an indefinite postponement of the sale. As a result of this request the following joint resolution was approved:

[Public Resolution No. 65, Sixty-third Congress. H. J. Res. 391.]

Joint Resolution Authorizing the Secretary of Commerce to postpone the sale of fur-seal skins now in the possession of the Government until such time as in his discretion he may deem such sale advisable.

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That the Secretary of Commerce be, and he hereby is, authorized to postpone the sale of all skins now in possession of the Government, taken from seals killed on the Pribilof Islands for food purposes, under section eleven of the act of August twenty-fourth, nineteen hundred and twelve, until such time as, in his discretion, he shall deem advisable; and the proceeds of such sale shall be covered into the Treasury of the United States.

Approved, February 24, 1915.

As the time of sale of fox skins taken on the Pribilofs is not fixed by law, no authority from Congress was necessary to secure the postponement of their sale.

In addition to the skins shipped to St. Louis a few fur-seal skins and fox skins were shipped for scientific and exhibition purposes.

NOTES ON FUR SEALS, ST. PAUL ISLAND, 1914.

In 1914 the first bull was reported on Reef Rookery on April 25. Arrivals at other rookeries were noted as follows: May 3, Sivutch (Sea Lion Rock) and Gorbatch; May 4, Kitovi; May 8, Zapadni; May 9, Tolstoi; May 10, Polovina, and Northeast Point.

The first bachelors were seen in the water between Sivutch (Sea Lion Rock) and the Reef on May 3. The first hauled out were noted at Northeast Point, May 10.

The first cow was seen on Gorbatch, on June 18, and had already given birth to a pup.

The first seals killed were by watchmen at Northeast Point, on May 17, when six were slaughtered. The first regular food killing took place on May 30, when a drive was made from the Reef.

The last killed, which were among the last lot seen on the island during the year, were taken by fox hunters at Northeast Point on December 14. For the year 1913 the last killing was on December 30, when 130 out of a drive of 305 were slaughtered on Sivutch (Sea Lion Rock).

At the end of the year there were a few seals still hauled out on Sivutch (Sea Lion Rock), or occasionally seen in the waters adjacent to the Reef Peninsula.

NOTES ON FUR SEALS, ST. GEORGE ISLAND, 1914.

North Rookery.—Seals made their first appearance April 29, when one bull hauled out on North Rookery. By May 9 the number of bulls had increased to 15 and several bachelors were noted in the water close to the beach. By May 23, there were 37 bulls in position on the breeding ground and 4 young bulls were observed loitering around the edges awaiting an opportunity to take up positions and establish harems. By June 4 there were 59 bulls in position, but some of these were young bulls that later deserted their places, retiring to the outskirts of the breeding ground. From this date on, the accession of bulls became rapid until the maximum was reached on July 20, when 94 were established with harems.

The first cow arrived June 10. Five days later 9 had arrived, 5 of which had taken their places in harems. From June 15 the increase in cows was rapid and 1,340 were counted July 1.

On June 17 the first pups were seen, when 6 were observed. By June 21 the number had increased to 27 and 4 days later to 107. By reason of the nearness of North Rookery to St. George village, and because of the high bluff that stands immediately in its rear, this rookery lends itself more readily than any other to observation.

Seals branded in 1912.—The first 2-year-olds bearing the 1912 "T" brand were observed in a drive made from East Rookery on June 29. Beginning July 16, and at the request of the special investigators, all branded 2-year-olds on making their first appearance in drives were given a distinctive mark for the season by clipping the hair from the left side of the head. Two hundred and eight were marked in this manner. On many of these branded seals the brands were very faint, due, in the opinion of the agent and caretaker, to insufficient searing when the branding iron was used. The faint brands were almost imperceptible in wet weather when the wet fur lay close to the skin. From the close scrutiny necessary to observe the brands in many instances it is probable that some faintly branded seals escaped observation. It is interesting to note that while branded

2-year-olds appeared in 13 drives subsequent to July 16, the date when special marking was begun, only two of those so marked were noted in those 13 drives. None of the branded seals showed any signs of having suffered any inconvenience or injury from being branded.

Census of Native Inhabitants, St. Paul Island, Alaska, June 30, 1914.

Names of individuals (grouped by families).	Age.	Birthplace.
Balakshin, Matrona	66	St. Paul Island
Bourdukofsky, Apollon.	61	Unalaska.
Bourdukofsky, Peter	35	St. Paul Island.
Bourdukofsky, Alexandra.	23	Marjovi.
Bourdukofsky, Martha	3	St. Paul Island.
Buterin, Constantine	28	Do.
Buterin, Marena	24	St. George Island.
Buterin, Alexandra	2	St. Paul Island.
Buterin, Karp	62	Do.
Buterin, Parascovia	60	Unalaska.
Bogodanoff, Agrafina	17	St. Paul Island.
Emanoff, Oulianna	5	Do.
Emanoff, Mary	39	Atka Island.
Emanoff, Joaniki	13	St. Paul Island.
Emanoff, Peter	11	Do.
Emanoff, Mammonth	8	Do.
Emanoff, Maxim	3	Do.
Fratis, Akalina	41	Unalaska.
Fratis, Agrafina	22	St. Paul Island.
Fratis, Oulianna	18	Do.
Fratis, Martha	15	Do.
Fraties, John	28	Do.
Fraties, Sandulia	24	Do.
Fraties, David	4	Do.
Fraties, Anton	1	Do.
Galaktionef, Alexander.	42	Atka Island.
Galaktionef, Lukeria	37	St. Paul Island.
Hanson, Anna	14	Do.
Galaktionef, Mary	12	Do.
Galaktionef, Matrona	11	Do.
Galaktionef, Aggie	8	Do.
Galaktionef, Ellen	5	Do.
Gromoff, Oulianna	45	Do.
Stepetin, Elary, jr	13	Do.
Rookavishnikof, Andrew	9	Do.
Hopof, Nekita	26	Do.
Hopof, Parascovia	25	Do.
Hopof, John	6	Do.
Hopof, Platonida	4	Do.
Kochutin, Jacob	63	Do.
Kochutin, Alexandra	51	Unalaska.
Mandregan, Nekifer	18	St. Paul Island.
Kochutin, John	44	Do.
Kochutin, Claudia	31	St. George Island.
Vickaloff, Alexander	17	St. Paul Island.
Kochutin, Erena	11	Do.
Kochutin, Simeon	2	Do.
Kochutin, Theodore	26	Do.
Kochutin, Mary	28	Do.
Kochutin, Karp	9	Do.
Kochutin, Augusta	3	Do.
Kochutin, Nekifer	1	Do.
Kochutin, Trefan	29	Do.
Kochutin, Natalia	34	Unga.
Kochutin, Prascodia	6	St. Paul Island
Kochutin, Zenobia	45	St. Paul Island.
Kochutin, Innokenty	11	Do.
Kochergin, George	36	Do.
Kochergin, Agafia	35	Do.
Tetoff, Peter	12	Do.
Stepetin, Gavriel	3	Do.
Kozeroff, Ivanally	26	Do.
Kozeroff, Foekla	19	St. George Island.
Kozeroff, Alexandra	(a)	St. Paul Island.
Kozlof, Michael	29	Do.
Kozlof, Eustina	39	Kiska Island.
Kozlof, Olga	(a)	St. Paul Island.
Kozlof, Nicolai	26	Do.
Kozlof, Olga	24	Holy Cross Mission.
Kozlof, Parascovia	55	Unalaska.
Koshevnikof, Paul	32	St. Paul Island.
Koshevnikof, Mary	40	St. George Island.
Koshevnikof, Evdokia	5	St. Paul Island.
Krukof, Katherine	56	Kamschatka (Siberia).
Tetoff, Agrafina	12	St. Paul Island.
Krukof, Condrat	24	Do.
Krukof, Vassa	19	Do.
Krukof, Maxim	1	Do.
Krukof, John	34	Do.
Krukof, Uleta	30	Do.
Krukof, Alexandra	8	Do.
Krukof, Tatiana	5	Do.
Krukof, Cleopatra	4	Do.
Krukof, Metrofan	31	Do.
Krukof, Pelagie	26	St. George Island
Krukof, Metofay	5	St. Paul Island.
Kushin, Michael	30	Do.
Kushin, Matrona	23	Do.
Kushin, Lukeria	2	Do.
Kushin, Nestor	22	Do.
Kushin, Nellie	22	Marjovi, Alaska.
Mandregan, Innokenty.	24	St. Paul Island.
Mandregan, Mary	17	Do.
Mandregan, Neon	(a)	Do.
Mazeekin, John	25	Do.
Mazeekin, Natalia	28	Unalaska.
Mazeekin, Victor	6	St. Paul Island
Mazeekin, Anna	4	Do.
Melovidov, Alexander	40	Do.
Melovidov, Salome	39	Do.
Melovidov, Alexandra	12	Do.
Melovidov, Alfay	11	Do.
Melovidov, Joseph	7	Do.
Melovidov, Anton	20	Do.
Melovidov, Alexandra	19	Do.

[a] Infant.

CENSUS OF NATIVE INHABITANTS, ST. PAUL ISLAND, ALASKA, JUNE 30, 1914—Con.

Names of individuals (grouped by families).	Age.	Birthplace.
Merculief, John	30	St. Paul Island.
Merculief, Evdokia	43	St. Michael.
Merculief, Serefimia	10	St. Paul Island.
Merculief, Leonti	7	Do.
Merculief, Agafia	36	Do.
Merculief, Paul, jr	20	Do.
Merculief, Terrenty	11	Do.
Merculief, Dosofay	9	Do.
Merculief, Makar	5	Do.
Merculief, Marian	3	Do.
Merculief, Paul, sr	24	Do.
Merculief, May	22	Umnak Island.
Nozekof, Simeon	37	Unalaska.
Nozekof, Avdotia	39	St. Paul Island.
Nozekof, Mary	16	Do.
Tetoff, John	10	Do.
Rookavishnikof, Katherine.	7	Do.
Orloff, J. E. (Rev.)	55	Sitka.
Orloff, Alexandra	17	Holy Cross Mission.
Emanoff, Alexai	15	St. Paul Island.
Oustigof, Neil	24	Do.
Oustigof, Mary	18	Do.
Oustigof, Peter	(a)	Do.
Oustigof, Peter	50	St. George Island.
Oustigof, Ellen	41	St. Paul Island.
Oustigof, Demetri	10	Unalaska.
Oustigof, Parascovia	6	St. Paul Island.
Pankof, Parfiri	52	Do.
Pankof, Varvara	33	Attu Island.
Pankof, Martha	16	St. Paul Island.
Melovidov, Marcia	5	Do.
Pankof, Vlass	26	Do.
Pankof, Agrafina	26	Do.
Shabolin, Matrona	14	Do.
Shabolin, Daniel	11	Do.
Rookavishnikof, Stepan	33	Do.
Rookavishnikof, Elizabeth.	27	Do.
Rookavishnikof, Marfa.	5	Do.
Rookavishnikof, George	2	Do.
Sedick, Innokenty	30	Do.
Sedick, Ripsimia	22	Do.
Sedick, Theofania	3	Do.
Sedick, Leonti	(a)	Do.
Sedick, Theodore	70	St. Paul Island.
Sedick, John	17	Do.
Shaisnikoff, George	32	Do.
Shaisnikoff, Evdokia	23	Unalaska.
Shaisnikoff, Sergius	9	St. Paul Island.
Shaposhnikoff, Parascovia.	48	Do.
Stepetin, Dorofay	44	Do.
Stepetin, Lubof	35	Do.
Stepetin, Auxenia	15	Do.
Stepetin, Helena	9	Do.
Stepetin, Auxenty	6	Do.
Stepetin, Epati	5	Do.
Stepetin, Capatolina	2	Do.
Stepetin, Elary, sr	51	Do.
Stepetin, Anna	35	Unalaska.
Stepetin, Nicolai	11	St. Paul Island.
Stepetin, Peter	6	Do.
Stepetin, Andrew	(a)	Do.
Stepetin, John	35	Do.
Stepetin, Vera	34	Do.
Stepetin, Marena	16	Do.
Stepetin, Vassili	12	Do.
Stepetin, Larion	10	Do.
Stepetin, Olga	8	Do.
Stepetin, Evdokia	5	Do.
Stepetin, Alexandra	3	Do.
Stepetin, Vassili	21	Do.
Tetoff, Neon	45	Do.
Tetoff, Agrafina	39	Unalaska.
Tetoff, Demetri	17	St. Paul Island.
Tetoff, Irena	14	Do.
Tetoff, Anna	7	Do.
Tetoff, Sosepatra	3	Do.
Tetoff, Agnes	(a)	Do.
Tetoff, Peter	50	Do.
Tetoff, Mary	52	St. George Island.
Stepetin, Cheonia	19	St. Paul Island.
Melovidov, Vincent	4	Do.
Tetoff, Zachar	35	Do.
Tetoff, Daria	34	St. George Island.
Tetoff, Paul	9	St. Paul Island.
Tetoff, Benedict	7	Do.
Tetoff, Mark	3	Do.
Tetoff, Theodosia	1	Do.

[a] Infant.

Summary of native inhabitants.

Males, above the age of 16 years	49
Males, between 5 and 16 years of age	31
Males, under 5 years of age	14
Total males	94
Females, above the age of 16 years	54
Females, between 5 and 16 years of age	28
Females, under 5 years of age	16
Total females	98

Total native population, June 30, 1913	194
Arrivals during year ended June 30, 1914	1
Births during year ended June 30, 1914	9
Departures during year ended June 30, 1914	3
Deaths during year ended June 30, 1914	8
Dropped from native census (married white)	1
Total native population, June 30, 1914	192

CENSUS OF NATIVE INHABITANTS, ST. GEORGE ISLAND, ALASKA, JUNE 30, 1914.

Names of individuals (grouped by families).	Age.
Galanin, Alexander	28
Galanin, Mary	23
Galanin, Katharine	5
Galanin, Helena	3
Galanin, Moses	(a)
Galanin, Akalina	52
Galanin, John	32
Galanin, Anna	32
Galanin, Gavriel	5
Galanin, Akalina	3
Galanin, Panteleiman	2
Galanin, Raphael	(a)
Kashevarof, Walter	27
Kashevarof, Helena	30
Kashevarof, Andrew	7
Kashevarof, Nina	5
Kashevarof, Laurence	4
Kashevarof, Valentine	2
Kashevarof, Peter	(a)
Lekanof, Anatole	24
Lekanof, Agnes	18
Lekanof, Alexandra	2
Lekanof, Agafangle	(a)
Lekanof, Stepan	44
Lekanof, Pelegia	44
Lekanof, Sergius	22
Lekanof, Marina	19
Lekanof, George	17
Lestenkof, Dimitri	52
Lestenkof, Alexandra	35
Lestenkof, Constantine	16
Lestenkof, Elizabeth	6
Lestenkof, Innokenty	4
Lestenkof, Theodore	2
Lestenkof, Michael	(a)
Lestenkof, Michael	41
Lestenkof, Oulita	44
Lestenkof, Anna	15
Malavansky, Nicoli	49
Malavansky, Ripsimia	56
Malavansky, Wassie	39
Malavansky, Christopher	10
Malavansky, Julia	2
Merculiof, George	40
Merculiof, Stepeneda	35
Merculiof, Peter	15
Merculiof, Sophia	12
Merculiof, George, jr	11
Merculiof, Nicoli	8
Merculiof, Alexandra	7
Merculiof, Daniel	2
Merculiof, Martha	21
Merculiof, John	23
Merculiof, Sarah	21
Merculiof, Clara	1
Merculiof, Mouza	(a)
Merculiof, Joseph	42
Merculiof, Polyxenia	4
Merculiof, Nicoli	34
Merculiof, Laurence	13
Merculiof, Benjamin	9
Merculiof, Elizabeth	7
Merculiof, Nicoli, jr	5
Merculiof, Angelina	3
Merculiof, Ariadne	1
Merculiof, Elikonida	(a)
Merculiof, Alexandra	36
Merculiof, Peter	5
Merculiof, Paul	3
Niderazof, Isidor	23
Niderazof, Alexandra	23
Niderazof, Clement	2
Philomonof, Andronic	47
Philomonof, Zenobia	48
Philomonof, Alexandra	18
Philomonof, Leonti	20
Philomonof, Eoff	12
Philomonof, Dimitri	28
Nozekof, Paul	18
Philomonof, Simeon	63
Philomonof, Avdotia	43
Philomonof, Zoya	22
Philomonof, Ignati	14
Philomonof, Julia	12
Philomonof, Helena	10
Philomonof, Nedesda	4
Philomonof, Isaac	2
Prokopiof, Peter	50
Prokopiof, Stepeneda	37
Prokopiof, Martha	18
Prokopiof, Marina	16
Prokopiof, Alexander	12
Prokopiof, Laurence	10
Prokopiof, Fevronia	9
Prokopiof, Mary	7
Prokopiof, Anna	6
Prokopiof, Afanasia	5
Prokopiof, Marthe	4
Prokopiof, Helena	2
Prokopiof, Sophia	(a)
Shane, Michael	26
Shane, Raiese	62
Merculiof, Stepan	23
Shabolin, Varvara	18
Shabolin, Julia	(a)
Swetzof, Paul	22
Galanin, Fevronia	37
Swetzof, Zoya	28
Swetzof, Agnes	7
Swetzof, Eleazar	5
Zacharof, Emanuel	34
Zacharof, Mary	40
Zacharof, Daria	12
Zacharof, Katherine	8
Kashevarof, Peter	57
Kashevarof, Anna	49
Pavlof, Katherins	20

[a] Infant.

Summary of native inhabitants.

Number native inhabitants last census	110
Increase by births during year	9
Decrease by deaths during year	2
Total native population, June 30, 1914	117

SCHOOLS.

While schools have been maintained on the Pribilof Islands for the instruction of the native children for many years, the results have proved far from satisfactory. This has been due to certain influences which are more or less beyond the power of the Government to restrain, to the natural indisposition of the people themselves to acquire an education, to the more or less constant change in the personnel of the teachers, and to the general laxity in regard to such matters bound to exist in such isolated communities as the Pribilof Islands.

On St. Paul Island an eight-months' term constituted the school year 1913–14, continuing from September to April, a total of 149½ school days. Instruction was furnished to 26 boys and 16 girls, ranging in age from 5 to 15 years.

In addition to instructions in the primary branches of a common English education, efforts were made to inculcate a knowledge of practical affairs of daily consequence. Special efforts were made to interest the pupils in local geography, in the natural history of the surrounding region, in the history of its inhabitants, and their relation to the rest of the world.

In the latter half of 1914, extensive repairs were made to the school building and a building formerly used as a gun house was converted into an auxiliary school building. The fall term of school in 1914 began the first Tuesday in September with an enrollment of 59 pupils, by the end of the year 65 were enrolled. The use of English, words exclusively, was insisted upon. A process of tanning hair-seal skins, bird skins, and the fragment of fur-seal skin known as the mask has been developed and taught to those most fitted for such work. A method has also been worked out for preparing the throats of fur seals, from which a beautiful and peculiarly grained leather may be made. Basketry work has also been undertaken, and as the natives have taken an interest in this subject it is possible that an industry of some economic importance may be developed.

On St. George Island, for the school year 1913–14, the term began September 1 with an attendance of 25 pupils—13 girls and 12 boys. This number included all the children between the ages of 6 and 16 years on the island. The school was closed on April 24, sessions having been held on 151 days. The teacher, also, gave instruction to the older native men, in the methods of working ropes, making fish nets, tempering and working steel, and the use of the turning lathe.

During the year two native boys, Constantine Lestenkof and George Lekanof, residents of St. George Island, entered the Salem Indian Training School at Chemawa, Oreg.

MEDICAL SERVICES.

On both St. Paul and St. George Islands a physician was employed throughout the year.

The report of the St. Paul physician for the year ended June 30, 1914, showed that during that period 280 cases were treated; among these were 40 cases of bronchitis. During this period there were 8 deaths. Comments were made on the general lack of cleanliness and the negligence shown in regard to carrying out instructions for the care of the sick. Complaint, also, was made of the attitude exhibited toward the physician in respect to the performance of his official duties. Superstition and the unmoral conditions were also made the subject of comment. To the rather steady habit of quass drinking was attributed a number of cases of stomach troubles existing among the adults.

As a result of this and other reports received, the Department has made special efforts to inaugurate more sanative conditions and attempted to instill in the natives a more wholesome respect for the authority of the physicians and a keener appreciation of what the Government is endeavoring to do for their comfort and welfare. Later reports indicated that decided improvements have been effected.

During the winter of 1913 an addition was built on the old dispensary on St. Paul Island, but lack of funds deferred its completion until after the close of the last fiscal year. A small building which had been used for the storage of clean salt was found to be in sufficiently good condition and of ample size for present needs as a hospital. The work of preparing it for the use of the medical department was commenced in August, 1914. Physical obstacles incident to moving it a distance of some 200 yards over uneven ground and without the proper equipment for such an undertaking, were the cause of considerable delay in getting the building on its new location. It is now located on the main north and south street of the village, opposite and but a short distance from the dispensary. The building is supported on a substantial rockwork foundation and is well put together. Two additions were built, one as an entrance vestibule, in front; the other, containing kitchen entrance, coal room, and toilet, on the side. A new roof, pierced by two chimneys, was found necessary and was supplied.

Dr. William M. Murphy was employed as physician of St. George Island throughout the year. On St. Paul Island, Dr. Henry Esmond acted as physician during the first part of the year, he was succeeded by Dr. William B. Hunter.

WATER-SUPPLY SYSTEM, ST. PAUL ISLAND.

During the summer of 1914 a repair party landed by the U. S. S. *Buffalo* placed the gasoline pump in working order at the Navy well, and installed a new pump at the radio station, which, by relaying from a tank located there, has kept a full supply of water, slightly brackish but still suitable for drinking, in the Bureau's tanks on Village Hill. During the fall the hydrant house was removed from near the senior school to a central position adjacent to the following principal buildings: Government house, company house, shop, and store. Hose sufficient to serve the church, hospital, laboratory, dispensary, stable, salt house, several warehouses, and about a third of the natives' dwellings was installed, partly on racks in the hydrant house and partly on a hand reel cart. Over 800 feet of 2-inch galvanized iron-pipe main were laid down the hill from the tanks connected with a double plug in the hydrant house. Arrangements were made with the radio station to operate the pumps, the fuel consumed thereby to be replaced by the Bureau at the end of the fiscal year. Under the instruction of the chief operator of the radio station a native was trained to run the pumps and has proved fairly competent in the work.

Running water was piped into tanks installed in the attic of the Government house and thence into the bathroom, and plans are made for extending the service to the company house, laundry, dispensary, laboratory, and hospital, during the summer of 1915.

NATIVES' BANK ACCOUNTS.

As noted in the report of the Alaska fisheries and fur industries in 1913, the trusteeship of the natives' savings accounts was, with agreement of all the natives except one, transferred in 1913 to Mr. F. M. Chamberlain, then naturalist on the Pribilof Islands. Owing to Mr. Chamberlain's retirement from the service, no one in the Bureau had authority to supervise these funds, which were deposited in the Union Trust Co. of San Francisco. During the year steps were taken to have the United States Commissioner of Fisheries become trustee. On account of the infrequent communication with the Pribilofs and the difficulty in securing proper execution of the necessary documents involved, the matter was still in process of adjustment at the end of the year.

FOXES.

Both St. Paul and St. George Islands are inhabited by blue foxes, and the proceeds secured from the sale of pelts of these animals yield a revenue to the Government sufficient to warrant considerable attention being paid them. Owing to the small number of fur seals killed upon the islands annually, it is necessary to secure from other sources meat to supply the foxes with food during the winter season when the natural supply is insufficient. Whale meat, when available, and salted salmon have been utilized. Due to the lack of cold-storage facilities the food, usually, has been preserved by salting. A considerable loss of foxes on St. George in the season of 1913–14 was attributed, in part, to the use of too much salt food. In the season of 1914–15 all salted food was freshened in water before being used and the marked improvement in the herd this season was probably due in large measure to this change in the condition of the food. The Pribilof Islands present a very favorable field for developing and improving methods of practical fox farming.

TAKING OF FOX PELTS.

St. Paul Island, Fall of 1913.

The fox traps were set out at noon, November 23, 1913, and taken in at the same hour on the 29th. The detailed catch at the different trapping camps is shown by the following table:

Take of Fox Pelts, St. Paul Island, November, 1913.

Districts.	Blue.		White.		Total.		Grand total.
	Male.	Female.	Male.	Female.	Male.	Female.	
Village and vicinity	22	15	4	2	26	17	43
Halfway Point	2	4	....	....	2	4	6
Northeast Point	30	17	5	2	35	19	54
North Shore	10	3	....	....	10	3	13
Northwest Point	3	5	1	1	4	6	10
Southwest Point	8	1	1	2	9	3	12
Southwest Bay	16	14	4	3	20	17	37
Total	91	59	15	10	106	69	175
Total, both sexes	150		25		175		

Summary of Weights of Foxes Taken on St. Paul Island, November, 1913.

Districts.	Blue.				White.			
	Male.		Female.		Male.		Female.	
	Number.	Average weight.	Number.	Average weight.	Number.	Average weight.	Number.	Average weight.
		Pounds.		*Pounds.*		*Pounds.*		*Pounds.*
Vicinity village	22	13.11	15	10.63	4	13.62	2	11.75
Halfway Point	2	9.50	4	12.25	....	....	....	....
Northeast Point	30	10.85	17	10.15	5	12.20	2	8.50
North Shore	10	10.75	3	11.17	....	....	....	....
Northwest Point	3	8.83	5	9.70	1	9.00	1	11.00
Southwest Point	8	11.50	1	9.00	1	15.00	2	10.75
Southwest Bay	16	11.12	14	9.32	4	11.25	3	9.83
Totals and averages	91	11.39	59	10.21	15	12.30	10	10.25

Average weights for both sexes were: Blue foxes, 10.93 pounds; white foxes, 11.48 pounds; all foxes, 11.01 pounds.

ST. PAUL ISLAND, FALL OF 1914.

Fox-trapping operations in the fall of 1914 were carried on about three weeks later than customary, an inspection of the catch of the preceding season by Deputy Commissioner Jones, while at St. Paul, in July, 1914, leading him to think that the traps had hitherto been put out before the pelts had reached their prime.

Traps were authorized to be set out on the evening of December 14 and were ordered taken up for the season on the morning of the 21st of same month. The following table shows the catches in the several districts:

TAKE OF FOX PELTS, ST. PAUL ISLAND, DECEMBER, 1914.

Districts.	Blue.		White.		Total.		Grand total.
	Male.	Female.	Male.	Female.	Male.	Female.	
Reef Peninsula	11	11	5	....	16	11	27
Kitovi	1	....	....	1	1	1	2
Lukanin	2	4	....	....	2	4	6
Tolstoi	8	7	3	2	11	9	20
Total, vicinity of village	22	22	8	3	30	25	55
Halfway Point	8	2	1	4	9	6	15
Northeast Point	41	22	6	1	47	23	70
North Shore	7	....	2	2	9	2	11
Northwest Point	5	5	....	1	5	6	11
Southwest Point	8	12	2	2	10	14	24
Southwest Bay	11	8	3	4	14	12	26
Total, all districts	102	71	22	17	124	88	212
Total, both sexes	173		39		212		....

SUMMARY OF WEIGHT OF FOXES TAKEN ON ST. PAUL ISLAND, DECEMBER, 1914.

Districts.	Blue.				White.			
	Male.		Female.		Male.		Female.	
	Number.	Average weight.	Number.	Average weight.	Number.	Average weight.	Number.	Average weight.
		Pounds.		*Pounds.*		*Pounds.*		*Pounds.*
Vicinity village	22	12.39	22	11.32	8	13.87	3	11.17
Halfway Point	8	11.94	2	10.25	1	14.50	4	9.50
Northeast Point	41	11.49	22	10.50	6	12.50	1	11.50
North Shore	7	10.14	....	....	2	11.75	2	11.25
Northwest Point	5	10.75	5	8.75	....	....	1	8.00
Southwest Point	8	10.25	12	9.54	2	12.62	2	11.25
Southwest Bay	11	11.45	8	9.84	3	11.87	4	9.31
Totals and averages	102	11.49	71	10.39	22	12.94	17	10.19

Average weights for both sexes were: Blue foxes, 11.03 pounds; white foxes, 11.74 pounds; all foxes, 11.17 pounds.

An examination of the pelts of the 1914 catch was made with the idea of determining, as far as possible from the results of a single season, what districts are the most productive in the finer grades of skins, as well as those in which the less desirable ones are taken.

The blue skins might have been graded through probably 30 or 40 different categories, the limits between which only an expert would be expected to decide with precision. They ran all the way from pelts with long, dark, glossy guard hairs, of regular length and deep evenly colored underfur, through many gradations in each important feature, to the short, patchy, irregular, pale and parti-colored hair and mottled, stained, dirty, and uneven fur.

The white skins were more easily graded, and fell readily into three classes of exactly equal numbers.

Some of the poorest blue skins were so pale as almost to intergrade with the least desirable class of the white, and it is thought that there is a tendency toward reversion, by the St. Paul herd, to the original white. In 1913, with a total catch of 175 foxes, the percentage of whites was $16\frac{2}{3}$; in 1914, of a total of 212 foxes of both colors, the whites were represented by $22\frac{1}{2}$ per cent, an alarming increase if this ratio should be continued.

For purposes of local record and future comparison and study, the blue pelts were grouped into four classes and the whites into three, as follows:

Blue fox skins.—First grade: Deep and glossy, dark guard hairs of even length, and prime fur of even color and quality. Second grade: The same except with a slight sprinkling of white among the guard hairs and a somewhat lighter colored fur. Third grade: More white among guard hairs and a reddish tinge to the pelt in general, paler fur, shorter and less even hair and fur. Fourth grade: All the least desirable skins, such as those with pale, mottled, mixed, and patchy hair and fur; short and uneven hair and fur; chafed areas; stained and dirty appearance, etc. The palest of these practically intergrade with the darkest of the white.

White fox skins.—First grade: Prime hair and fur of even length and color. Second grade: The same, but with bluish fur and somewhat shorter hair. Third grade: All inferior pelts.

ST. GEORGE ISLAND.

In the fall of 1914 the season for trapping foxes for their pelts began on December 13, and during the remainder of that month 63 blue-fox pelts and 1 white-fox pelt were secured. The killing was confined to foxes considered undesirable as breeders. During the same period, December 13 to 31, there were branded and released for breeding purposes 207 blue foxes, of which 122 were males and 85 females.

SALE OF BLUE FOXES.

In 1913 the Department, in order to encourage fox raising in Alaska and elsewhere in the United States, offered to sell under competitive bids blue foxes from the Pribilofs. It was planned that the Department would undertake to deliver at Unalaska any foxes which might be sold in this manner. Some bids were received but various obstacles interposed themselves, hindering the ready accomplishment of the plans, and their modification in respect to delivery at Unalaska had to be allowed. In the year 1914 two sales were effected:

(1) Six pairs of young blue foxes were shipped from St. George Island by the steamer *Melville Dollar* to San Francisco. The animals were for delivery to a person who had arranged for establishing a fox ranch in Michigan. Four of the foxes died while en route to San Francisco. For the foxes which were delivered the Government received $101 apiece.

(2) Ten pairs of young blue foxes were shipped from St. George Island on the fisheries steamer *Albatross* for delivery at Seward, Alaska, to a fox breeder conducting operations at Fairbanks, Alaska. Five pairs died while en route to Seward. For the foxes which were delivered the Government received $106 apiece.

The sale of many pairs of foxes could subsequently have been effected, but owing to the condition of the Government herds it was deemed unwise to hamper their future well-being by removing the best potential breeding elements.

REINDEER.

In 1911 a small herd of reindeer was introduced both on St. George and St. Paul Islands. Each successive year has shown uniformly satisfactory results, and it would seem that what was in the beginning an experiment is now an accomplished piece of work.

The following statement shows the increase in each herd from the date of introduction to June 30, 1914:

St. Paul Island.

Date of introduction: August 31, 1911.

Number introduced: 4 males, 21 females; total, 25.

Number present June 30, 1914: Age 1 year and upward, 15 males, 36 females; fawns, 24; total, 75.

St. George Island.

Date of introduction: September 1, 1911.

Number introduced: 3 males, 12 females; total, 15.

Number present, June 30, 1914: Age 1 year and upward, 11 males, 26 females; fawns, 21; total, 58.

SEA LIONS.

St. Paul Island.—The first sea lion killed on St. Paul in 1914 was at Northeast Point on January 24. One had been taken at the same place on December 27, and as it was the first of that season's herd, should be properly included in the 1914 catch. Others were killed as follows:

Between Jan. 25 and 30, at Northeast Point	3
Feb. 19, near Lukanin	1
May 17, at Northeast Point	1
May 21, in Village Cove	1
June 10, in a drive at Northeast Point	16
June 15, in a drive at Northeast Point	3

This made the total for the season 26, which included a cow overheated and trampled in the drive of June 10.

The sea lions were more than usually abundant at Northeast Point, a herd of more than 100 having been seen by hunters in the early part of June.

St. George Island.—A drive of sea lions was made on September 21 from East Rookery. The drive was made from a herd of about 75 animals, and was the first of any importance on this island for a number of years. Twenty-two large and medium-sized males were killed.

Uses.—Sea lion meat is used by the natives for food, both when fresh and preserved with salt. The skins are used primarily in the construction of the bidarras, or natives' boats, used by them in bringing supplies ashore from the supply vessels.

MINOR FUR-BEARING ANIMALS.

FIELD WORK.

The limited appropriation available for field work in connection with the protection of the minor fur-bearing animals for the fiscal year which ended June 30, 1914, made necessary some curtailment of this work. This inadequacy was compensated for to some extent by diverting a portion of the activities of the wardens to necessary work pertaining to the salmon fisheries. The appropriations for the fiscal year 1915 authorized an increase in the number of wardens from five to seven. The primary field duties of the wardens consist in enforcing the laws and regulations for the protection of the fur-bearing animals and in collecting such information in regard to those animals as will enable the Department to formulate regulations calculated to restrict as little as possible the fur industry in Alaska consistent with the conservation of the wild fur-bearers.

The principal places used as centers of operations of the various wardens during the year were Fairbanks, Afognak, Wrangell, and Copper Center, and efforts were made to have them cover as large an extent of surrounding territory as possible.

In addition to the regular wardens, one Alaska game warden with headquarters at Chicken was employed throughout the year as a special fur warden, at the nominal salary of $10 per month, for the purpose of securing the enforcement of the law and regulations protecting fur-bearing animals in the region under his supervision as a game warden.

NEW REGULATIONS.

In order to cooperate with those who desired to take up the business of fur farming, the Department in June, 1914, revised the regulations to the end of authorizing the taking, for use for breeding purposes in Alaska, of foxes and martens at any time, except from March 15 to June 30, both days inclusive, of each year, and of land otters and minks excepting the season from April 1 to June 30, both days inclusive, of each year.

At the same time the Department incorporated in the regulations provisions in regard to fur farming as follows:

> All persons engaged in Alaska in the business of breeding and raising fur-bearing animals in captivity shall first obtain from the Department of Commerce a license for that purpose, which shall be issued without charge, and they shall, on the 1st day

of September of each and every year hereafter, or within 15 days before or after said date, report to the Department of Commerce the number of animals of each species they have on hand at the date of such report, the number of each sex, whether captured in the wild state or raised in captivity, and such other information as may be required by the Department of Commerce. Permits will be issued to the owners and operators of such licensed fur farms or ranches in Alaska authorizing them to ship their ranch-bred stock from the Territory of Alaska.

As a result of the requirement that all persons engaged in fur farming in Alaska should procure licenses, many applications for licenses were received. At the end of the calendar year 1914 the Department had issued 43 licenses. Possibly a number of the persons to whom licenses were issued had no serious intention of engaging in the business, or if they did begin would not persevere long enough to make the business a success, yet there is every reason to believe the business of fur farming is receiving considerable attention.

WEAKNESS OF EXISTING LAW.

The existing law for the protection of the minor fur-bearing animals in Alaska is wholly inadequate to permit giving proper protection to the fur bearers. It prescribes penalties only for the actual killing of the animals, in violation of the law and regulations and does not provide for the enforcement of regulations quite as necessary for their protection as prohibitions on the killing. By a strict construction of the statute, the Secretary of Commerce is empowered only to authorize the killing of these animals under such regulations as he may prescribe and to prevent their killing contrary to the law and the regulations. The department has endeavored to regulate other activities which are recognized by everyone as detrimental to the proper preservation of these wild animals, but it is doubtful whether the courts would take cognizance of violations of regulations not clearly authorized by law. Possibly a better way would be for the Department to enforce the law literally. Bills were introduced in both the second and third sessions of the Sixty-third Congress for the purpose of providing a remedy for the present unsatisfactory condition, but they were not enacted into law.

VIOLATION OF THE LAW AND REGULATIONS FOR THE PROTECTION OF FUR-BEARING ANIMALS.

Reports are received from time to time alleging the taking of fur-bearing animals in violation of the law and regulations, particularly by means of poison. As far as possible the Bureau's employees have investigated these charges, and it must be stated that a great many of them are unfounded. Indians make them against white men, who they believe are encroaching on their trapping grounds.

They will make no accusations against each other, but will do all in their power to make trouble for the white trapper. White trappers sometimes bring charges against other trappers, presumably with the desire to get them out of the region. It would appear, also, that charges have been made by the Indians and white men with the expectation of securing appointments as guides to take a warden to the district where the violation is supposed to have occurred. Last summer the Bureau received a detailed account of an alleged flagrant violation of the law in respect to the taking of sea otter in the Prince William Sound region. The Bureau made a special effort to investigate the report and one interesting fact was brought to light. The person who made the charge stated that he would not have reported the case if he had not hoped thereby to be appointed a warden. On August 30, 1914, Warden Walker investigated a report at Hoonah of fishermen having seal and sea otter skins, and he learned that the report started in a joke. The Bureau would not state that there are not many violations of the law and regulations, but it does believe that the number of such violations is greatly exaggerated.

In January, 1914, 26 beaver skins were confiscated from a Nenana trader. The trader, several months later, made out an affidavit to the effect that he had purchased the said 26 beaver skins from the Northern Commercial Co. in 1909, through a captain of one of the river boats. The captain stated that he had purchased a number of beaver skins for the said trader at the time stated, though, of course, he could not say as to whether or not they were the same skins as those seized. As reliable evidence contrary to the above could not be obtained, the skins were finally returned to the Nenana trader.

In February, 1914, two persons were convicted jointly in the commissioner's court at Haines of having unlawfully killed four foxes by the use of poison.

NOTES ON FUR-BEARING ANIMALS.

Beaver.—In southeastern Alaska beavers have increased rapidly in numbers. Not only have the old colonies been augmented but new ones have been established, with the result that lakes and creeks formerly unoccupied are now inhabited by them. They are becoming quite plentiful in certain parts of the interior of Alaska, especially in the lower Yukon region. The killing of the beaver throughout Alaska is prohibited until November 1, 1918. The indications are that by that time these animals will have reestablished themselves in such numbers that an open season for their killing may be desirable. Owing to their peculiar habit of associating themselves in colonies which may be completely exterminated readily, the problem of how to permit killing and at the same time to preserve these animals from practical extinction, is a difficult one.

During the year 1914 beaver skins were found in the possession of different parties. The claim was generally made, however, that such skins were imported from Canada or were secured prior to the establishment of the closed season on beaver. In such cases it is practically impossible to secure any definite evidence in regard to the facts.

Sea otter.—The North Pacific Sealing Convention of July 7, 1911, prohibits the killing of sea otter on the high seas by citizens of the United States, and the law and regulations for the protection of fur-bearing animals in Alaska prohibit the killing of them within the territorial limits of Alaska.

There are occasional reports of the taking or proposed taking of sea otters, but the Bureau has not been able to secure good evidence of an actual violation of law.

On March 10, 1914, the W. J. Erskine Co., of Kodiak, purchased a sea-otter skin of Alexander Lukin, a native of Afognak Island. Affidavit was made by Lukin that the skin was taken from a dead animal found floating in the water near the beach at Shuyak Island. The skin was subsequently shipped to San Francisco, and the legal phases in regard to the matter having been reviewed by the Solicitor for the Department, the skin was marked and authenticated, as contemplated by the North Pacific Sealing Convention, by a representative of the Bureau.

Land otter.—Land otter are very scarce in the interior of Alaska but fairly abundant on the coast. Owing to the wandering habits of these animals, they are difficult to catch and so are not seriously affected by trapping.

In southeastern Alaska, where they are found generally, they are reported as maintaining their numbers well. They are most abundant on the islands. In the Prince William Sound region they are quite plentiful.

Wolves.—It would appear that in southeastern Alaska wolves are on the increase, and it is probable that but few of the islands in that region are entirely free from them. A warden with headquarters at Chicken, in the eastern part of Alaska near the Klondike region, reported in January, 1915, that wolves were in greater abundance thereabouts than ever before. They are very destructive to deer and are charged with the destruction of reindeer. They are said to consume large quantities of salmon.

In 1912 a total of 103 wolf pelts was shipped from Alaska, 163 in 1913, and 44 in 1914. No protection is afforded these animals, and in view of their evident increase it would seem advisable that a bounty be paid for each wolf killed in order to reduce their numbers.

SHIPMENTS OF FURS FROM ALASKA.

The Department requires that all shipments of furs from Alaska shall be reported to the Bureau of Fisheries for statistical purposes. The Bureau provides two forms for use by the shippers in making the reports. One form is for shipments by mail and its correctness must be certified by the postmaster at the place from which shipment is made. The other form is for reporting shipments made otherwise than by mail, i. e., by freight, express, personal baggage, etc.

The following table shows the number of pelts shipped from Alaska of the various kinds of fur-bearing animals in the years ending November 15, 1912, November 15, 1913, and November 15, 1914, respectively. The table does not include shipments made from the Pribilof Islands, information concerning which is given elsewhere in this report.

MINOR FURS SHIPPED FROM ALASKA IN 1912, 1913, AND 1914.[a]

Species.	Year ended Nov. 15, 1912.			Year ended Nov. 15, 1913.			Year ended Nov. 15, 1914.		
	Number of pelts.	Average value .	Total value.	Number of pelts.	Aver age value.	Total value.	Number of pelts.	Average value.[b]	Total value.
Bear:									
Black	698	$7.50	$5,212.50	1,363	$12.57	$17,132.91	663	$12.57	$8,333.91
Brown	19	9.00	171.00	38	9.00	342.00	32	9.00	288.00
Glacier	5	15.00	75.00	111	22.50	2,497.50	3	22.50	67.50
Grizzly	....	....	....	12	40.00	480.00	....	....	....
Polar	9	40.00	360.00	72	40.00	2,880.00	104	40.00	4,160.00
Beaver	89	10.00	890.00	25	10.00	250.00	10	10.00	100.00
Ermine	7,957	1.36	10,821.52	6,559	.96	6,296.64	6,873	.96	6,598.08
Fox:									
Black	3	600.00	1,800.00	24	253.00	6,072.00	13	253.00	3,289.00
Blue	502	45.00	22,590.00	892	46.59	41,558.28	239	46.59	11,135.01
Cross	603	17.00	10,251.00	768	14.24	10,936.32	1,380	14.24	19,651.20
Red	8,018	8.50	68,153.00	10,820	9.80	106,036.00	14,967	9.80	146,676.60
Silver gray	142	250.00	35,500.00	132	147.30	19,443.60	153	147.30	22,536.90
White	3,108	12.50	38,850.00	3,756	12.93	48,565.08	6,530	12.93	84,432.90
Hare, Arctic	55	.40	22.00	49	.40	19.60	1,263	.40	505.20
Lynx	2,720	21.50	58,480.00	4,772	12.35	58,934.20	6,930	12.35	85,585.50
Marten	12,999	12.50	162,487.50	9,682	7.56	73,195.92	6,497	7.56	49,117.32
Mink	31,363	4.50	141,133.50	47,062	4.46	209,896.52	35,623	4.46	158,878.58
Muskrat	123,925	.40	49,570.00	163,616	.33	53,993.28	101,202	.33	33,396.66
Otter:									
Land	1,480	14.00	20,720.00	1,300	10.70	13,910.00	1,008	10.70	10,785.60
Sea	1	200.00	200.00	....	....	....	1	200.00	200.00
Reindeer	4	1.00	4.00	5	1.00	5.00	....	....	....
Seal, hair	333	1.50	499.50	1,458	1.17	1,705.86	1,742	1.17	2,038.14
Squirrel	611	.08	48.88	34	.08	2.72	662	.08	52.96
Wolf	103	9.00	927.00	163	7.00	1,141.00	44	7.00	308.00
Wolverine	189	10.00	1,890.00	242	11.44	2,768.48	136	11.44	1,555.84
Total	....	....	630,656.40	....	....	678,062.91	....	....	649,692.90

[a] Neither the fur-seal nor the fox skins from the Pribilof Islands are included.
[b] Assuming same average values as for preceding year.

LEASING OF ISLANDS.

The Secretary of Commerce has authority to lease certain islands off the coast of Alaska for use for the propagation of foxes and other fur-bearing animals. By virtue of this authority, four islands were leased in 1914 for periods of five years each, as follows:

Island.	Lessee.
Carlson	Moose Bay Fur & Trading Co., Tacoma, Wash.
Middleton	Tim Marcum, Valdez, Alaska.
Simeonof	J. C. Smith, Sand Point, Alaska.
Little Koniuji	A. Grosvold, Sand Point, Alaska.

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